NATURAL HISTORY

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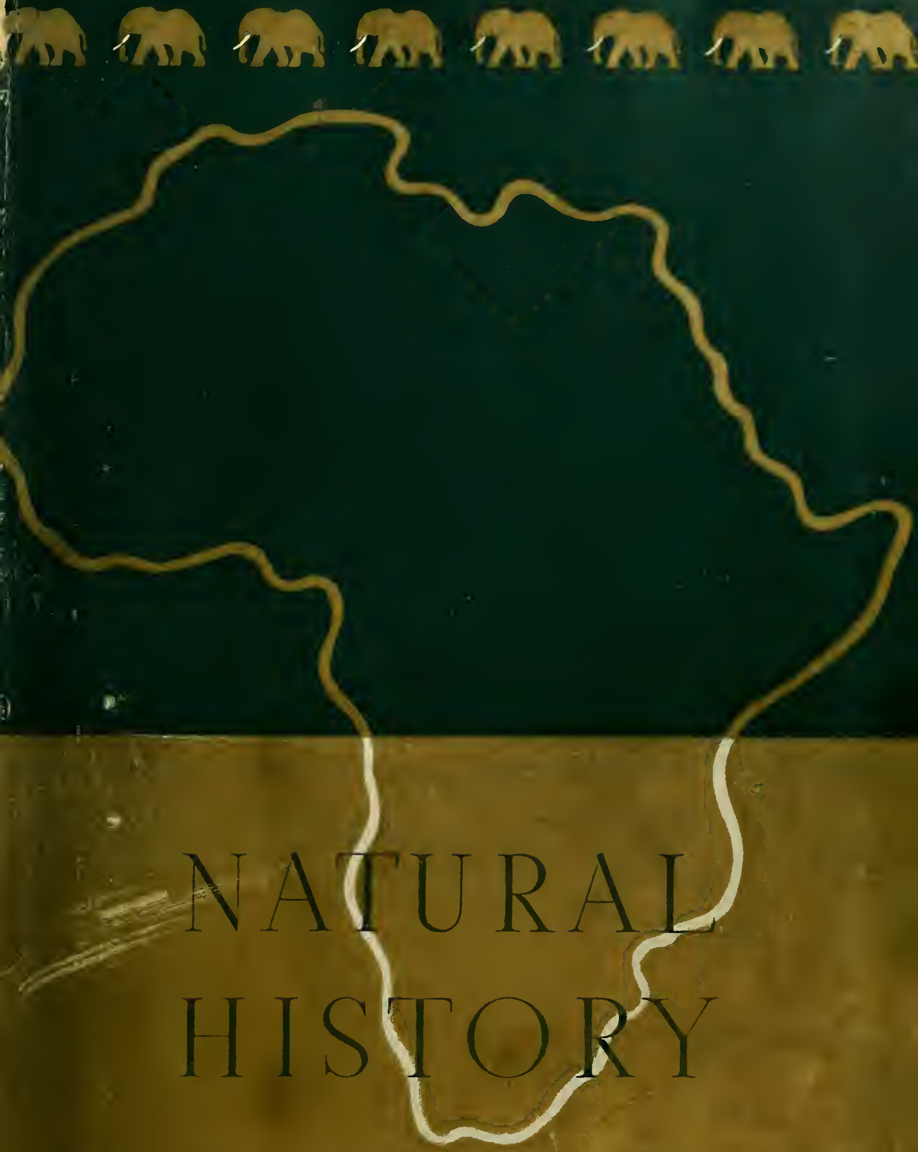

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No. 3 is the Gorilla [*Gorilla savagei*]. Here we see the Lake Kivu region of the Belgian Congo with the slope of Mt. Mikena showing in the purple sunset. This great animal was carefully studied by Carl E. Ackley on his many trips to Africa and from this theatre one will glean many interesting facts about a creature that has long been too little known.

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NATURAL HISTORY

The Journal of the American Museum of Natural History

VOLUME XXXVII ★ ★ ★ ★ JANUARY 1936

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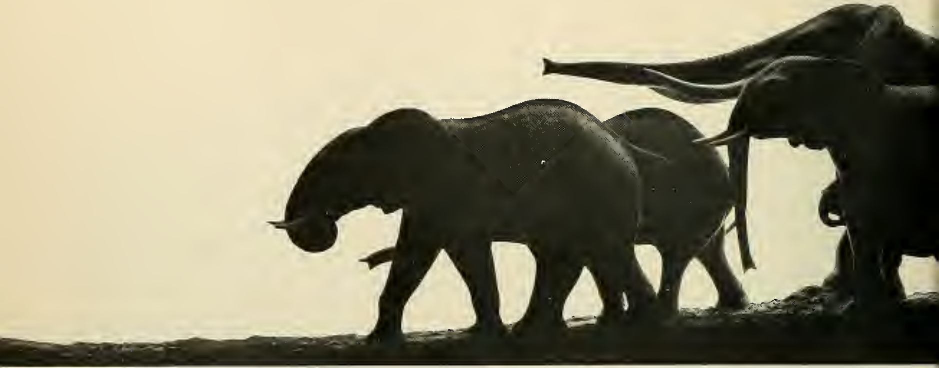
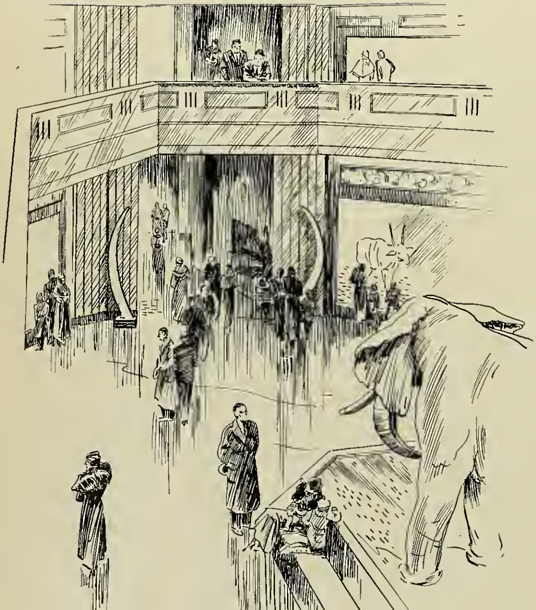
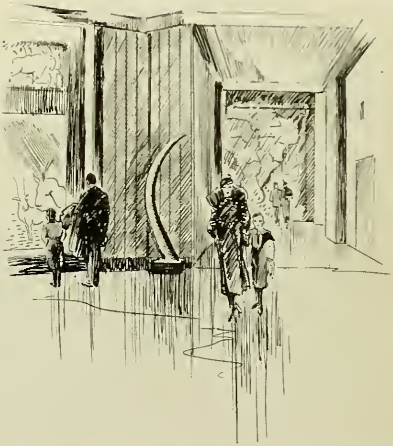


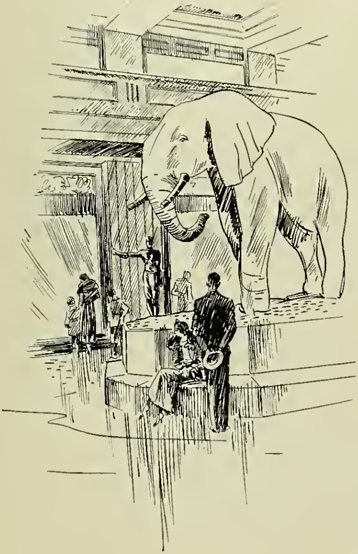


Glimpses Into

The new Akeley Hall of African Mammals opens to public view early in 1936, after years of planning and preparation, although some of the exhibits are still to be provided

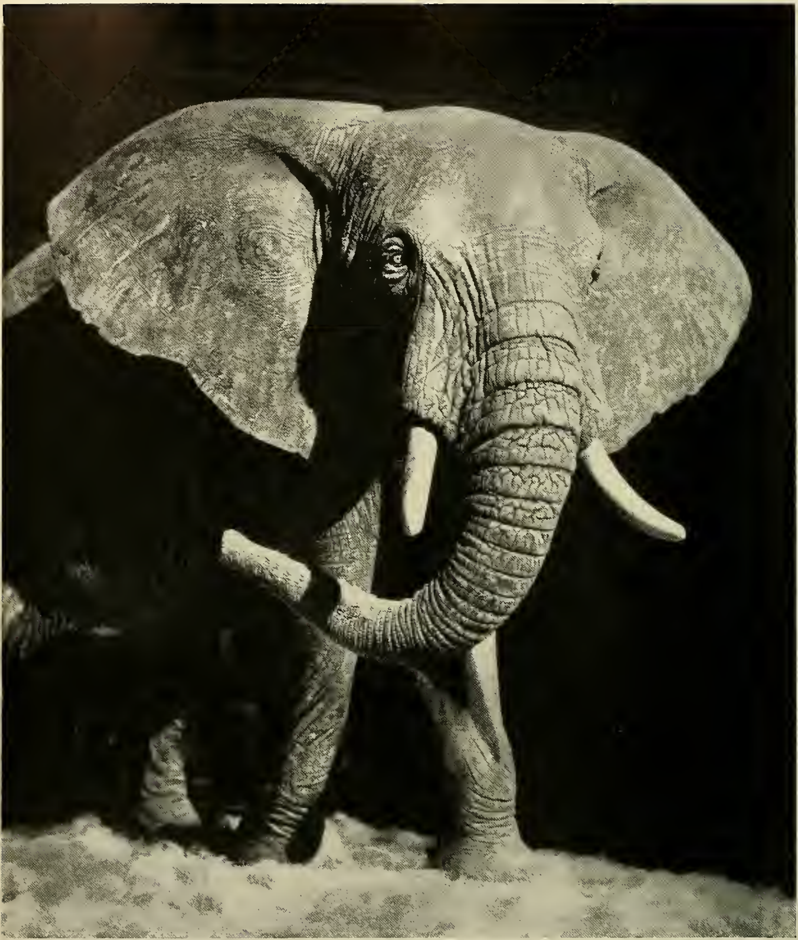
Akeley African Hall





Here are parts of the real Africa recreated in the American Museum as Carl Akeley dreamed. This has been made possible through the generosity of friends, and accomplished by the skill, artistry, and infinite labor of a large staff of workers in the Department of Arts, Preparation, and Installation.

Above is a silhouette of the "Elephant Herd" that dominates the hall, an exhibit unique in museum annals. The three drawings are by Frank Swain



Photograph by Wurts Bros.

THE REAR GUARD

In every herd of elephants at least one animal takes the responsibility of wheeling about at frequent intervals to see that all is well behind. The young male shown above is mounted in this position in the elephant herd which forms the central exhibit in the Akeley Memorial African Hall at the American Museum. It was collected by John T. McCutcheon in 1910, when he was in the field with Carl Akeley. It was during this expedition that the idea of a great African Hall first germinated in Akeley's mind.

"The Rear Guard" was prepared and mounted by Akeley

Akeley's Dream Comes True

The Akeley Memorial African Hall — a monument to the world's greatest wonderland of wild life

By Daniel E. Pomeroy

Akeley loved Africa.

He knew the primitive Africa, and he saw it being destroyed. It thus became the single purpose of his life to preserve and portray Africa for posterity. He dedicated his life to the task of bringing Africa to America.

Those of us who knew Akeley in the latter years of his life remember chiefly his mounting zeal in the approaching realization of his great dream. He was a man of tremendous nervous energy and with a single tremendous purpose. You had only to see the set of his lean jaw and the fire of inspiration in his eyes to know this.

Though slight in stature, he was wiry and strong, the slight stoop of his shoulders merely increasing the impression of latent vigor. Whether he was in his studio working out some new trick in the displaying of animals or following a jungle trail in quest of specimens, you felt the constant power of his great vision. Yet there was nothing grim about his personality. He had a ready sense of humor and was mellow with kindliness and fine sentiment.

His enthusiasm often resembled that of a youngster on vacation, and because of this youthful zest it was easy to visualize his early struggles.

Early ambitions

In the strictest sense of the term, Akeley was a self-made man. As he used to put it, by all the rules of the game he should have been a farmer. But he was always more interested in birds and chipmunks than in crops and cattle. And he was only sixteen years of age when he announced his life work by having business cards printed stating that he did "artistic taxidermy in all its branches." The portent of this pronouncement lies in the fact that at that time the mounting of animals was in no sense an artistic craft. Akeley saw the possibility of raising taxidermy to an art.

"Stuffing" versus art

Taxidermy before Akeley was scarcely more than a variety of upholstery. The expression "the stuffing of animals" was literally applicable, for the procedure was simply to turn the animal upside down and stuff it with straw, rags, paper, or other rubbish, and to distort the features into as ferocious an expression as possible. Lacking an adequate framework upon which the configuration of the body could be moulded, the specimen frequently bulged or shrank out of all harmony with its original anatomy. Then it would be stood up by itself in a case, without any background. The result was something far removed from nature.

All this offended Akeley's sensitive artistic conscience, even at an early age. Then followed his long years of pioneer work. Gradually he evolved the technique, described elsewhere in this issue of Natural History, which has been adopted by museums throughout the world.

In the end, Akeley won renown as a sculptor, an inventor, a naturalist, and an explorer. But these achievements were incidental to his enduring passion for artistic taxidermy and his ultimate purpose through it to create an African Hall.

The first definite seeds of Akeley's dream were planted when he went to Africa for the first time, in 1896.

Akeley's vision

A unique mental and artistic outlook gave a distinctive quality to his impressions. He had long since passed his apprenticeship in the workshops of Ward's Natural Science Establishment, and had devoted eight years in Milwaukee to the development of his own methods. Therefore, when he went to Somaliland with Prof. Daniel G. Elliot, a new world was opened up to him. This taste of the world's greatest wonderland of wild life created visions of unimagined possibilities for his artistry. He saw Africa's magnificent animal forms not as many others have as potential trophies, but as things of beauty to be preserved. Africa would be his vast studio. This awakening came to him almost forty years ago.

"I was so bewitched by the beauty and splendor of Africa," he wrote, "that it seemed to me inconceivable that I would not immediately return."

But nine years were to pass before he was able to go back. It was chiefly in this interval that he perfected the details of his display methods, which were to make possible his dream.

The result of his 1905 expedition was the elephant group, "The Fighting Bulls," in the entrance hall of the Field Museum.

He then wished to elaborate upon his studies on the elephant, which he had found to be the most fascinating of all wild animals, and to create a larger exhibit, requiring a spacious and impressive setting. The proposal he made to the American Museum of Natural History to collect a group was accepted, and in 1909 he again took up the trail, this time on the slopes of Mount Kenya and in Uganda.

A statuesque group of four elephants was planned as the central figure for African Hall. And immediately upon his return he set about mounting them. Subsequent expansion of the plans, however, increased the group to eight animals.

It was on this 1909 expedition that an old bull elephant, tired of being hunted by him, rudely interrupted his activities, as he put it, by using him as a prayer rug. The encounter nearly cost Akeley his life.

Anyone who knows how vigilant Carl Akeley was on the trail will take this incident as a warning that an emergency can arise in Africa against which the most skillful hunter is well-nigh helpless. When Carl suddenly became aware that the elephant was almost on top of him, he snatched up his gun and of course tried to shove the safety catch forward. It would not budge. He knew he must shoot instantly, and it is a measure of his desperation that he determined to pull the trigger hard enough to fire the gun no matter whether the safety had jammed or not—an altogether impossible feat. Then something happened which dazed him.

Without knowing whether he had shot or not, he suddenly felt a tusk right at his chest.

What he did next was the result of having mentally rehearsed such an emergency many times on the trail. He grabbed the tusk with his left hand, took hold of the other with his right and, swinging in between them, went to the ground on his back.

The elephant drove his tusks into the earth, his curled-up trunk against Akeley's chest. Akeley felt himself being crushed, then lost consciousness. The thing that stunned him was a blow from the elephant's trunk, which broke his nose and tore his cheek open to the teeth. But some obstruction in the soil which the tusks encountered saved Akeley from being crushed to death. The beast left him to charge the terrified native boys, who were his only companions at the time, and then escaped.

A return to life

Akeley lay unconscious for four or five hours. Believing him dead, the natives, in their superstition would not touch him. When consciousness returned to him, although he felt no pain, he could move neither his arms nor his legs, and concluded that his back was broken.

His back was not broken, but his chest had been badly damaged and several of his ribs had penetrated his lungs. He was in bed for three months.

Akeley always said, with his characteristic philosophy, that his invalidism was not a complete loss, for it gave him time to think out his great dream. However, it is likely that those injuries turned the tide against him in 1926 when fatal illness terminated his life, just at the eve of the realization of his dream.

The plan for an African Hall was well

crystallized in his mind when he returned to America in 1911.

On this expedition Akeley had discovered a serious handicap to his work. For the life-like re-creation of wild animals in museum displays, as well as for the study of their habits and actions under various circumstances, motion pictures were an essential adjunct. But no camera had been devised which was fast enough to enable a rough and ready naturalist to record rapidly moving events which were happening unexpectedly in different quarters. Akeley wanted a motion picture camera that you could aim about like a pistol. And so necessary was it to his work that he resolved not to return to Africa until he had produced one.

Engineers and mechanics at first declared Akeley's schemes for his camera to be wild dreams, impractical, impossible ideas of an untrained mind. But after long experimentation he completed a model, which bore no likeness to the conventional apparatus. To those familiar with the old types of camera, the Akeley resembled a machine-gun quite as much as it did a camera. Indeed, it is alleged that when a young lieutenant in the World War was setting up the machine, he was suddenly confronted by seven Germans, who mistook his formidable film apparatus for a new type of Yankee machine gun and threw up their hands in surrender.

Akeley's camera has been used on practically every exploration of consequence and also plays an important part in the production of news reels and in Hollywood. But Akeley had no thought of the commercial value of his invention. He devised it specifically for his task of bringing Africa to America.

The Akeley cement gun

Another invention which he hit upon in his studio work and which found practical applications in industry, was his cement gun. This is a device which enables one to spray liquid cement upon a vertical or inclined surface. Akeley first devised it for the purpose of modeling the manikins which serve as the foundation upon which the skins are mounted. Today the cement gun has a large and important commercial utility in various types of construction. During the war it was valuable in the building of concrete ships.

The World War interrupted Akeley's African program by diverting his abilities to technical problems in the service of the Government, and it was not until 1921 that he was able to return to Africa.

Collecting gorilla

The specific purpose in this expedition into the gorilla country was to collect scientific information about the most important yet least known of the manlike apes and to secure material for a group of these creatures for the Hall. The trip was made with Mr. and Mrs. H. E. Bradley. The locality in which the program of work was carried out was the mountain paradise of Kivu, which Akeley always said was the most beautiful spot in all the world. His favorite scene is reproduced in African Hall as the setting for the superb Gorilla Group. No one can challenge Akeley's opinion of its surpassing beauty or fail to appreciate the rapture he felt as a nature lover exploring in the mountains of Kivu.

Knowing his love of this section, there is additional meaning to us in the fact that it was precisely here that he passed away a few years later at the very peak of his career.

The last five years of Akeley's life were marked by rapid progress toward the creation of African Hall. Yet there were repeated discouragements, which continually threatened to frustrate him.

The creation of the Hall depended upon the achievement of three things. Of these the first, the development of the art of displaying animals in their true settings, had by now been accomplished. The second essential step was to train a body of specialists who could carry out the various processes: collectors, photographers, artists, taxidermists, anatomists, etc. Akeley spent years in developing the talents of men who were to assist him. Louis Jonas, who worked with him during these years has repeatedly spoken to me of Akeley's peculiar faculty for selecting just the man who was fitted for a particular job by ability and temperament.

"Mr. Akeley has a constant supply of surprising ideas," I remember his telling me in his enthusiasm. "His ingenious way of facing each problem as it comes along and working it out, is amazing. One minute you will think he has encountered the impossible obstacle; then a light comes into his eye and you know that he has changed failure into success."

His personality captivated Jonas, just as it did everybody else, from the moment he met him. The old khaki trousers he wore and the corncob pipe he smoked in his studio might have detracted from the bearing of anyone less of a true artist, but we all remember them as part of his beloved personality.

As Jonas has frequently impressed upon me, the encouragement and inspiration that Akeley gave to the rising naturalists of his day was one of his most valuable gifts, and will bring profound consequences for many years to come.

The third essential part in Akeley's plan was the task of convincing the patrons of natural history that his conception was worthy of their support. He had to show them that African Hall, a monument to the passing wild life of Africa, was as truly worthy of their support as any project in marble or on canvas.

A benefactor

This brings us to 1925, for it was then that the great opportunity came to Carl through his acquaintance with George Eastman, of the Kodak Company.

I first knew Eastman through business connections, but it was our mutual interest in the outdoors that drew us together. Eastman enjoyed camping and had made a number of trips into northwestern Canada, Alaska, and elsewhere. He had been interested in my trip to the Sudan in 1914, but the first evidence that his mind was seriously turning toward Africa came one day in the autumn of 1925 when he called me by telephone from Rochester and said: "When are you going to Africa?"

I thought he was joshing. "Any time you say," I answered.

"The best I can do," he said, "is a year from this December."

That was a long time ahead, but I went to Rochester to see Eastman right away. I saw that there was a great opportunity to make an expedition that would count for something in science. I was then a member of the American Museum of Natural History and knew of Carl Akeley's scheme. When I explained it to Eastman, I found him keen as a briar, and he authorized me to get in touch with Akeley.

Akeley always came straight to the point. "If Mr. Eastman is interested in African Hall, I am interested," he said. "If not, I'm not."

I asked Carl what he proposed Mr. Eastman should do.

"You know what my plan involves," he said. "I'd like to see Mr. Eastman give a million dollars."

That was beyond the bounds of possibility and I endeavored to tone Carl down.

"All right," he said. "But let's go right up to see him."

We took the night train.

Carl had been impeded so long by lack of funds that he scarcely dared believe anything would come of this. All that evening in the smoking car he was as excited as a man waiting to hear the verdict of a jury, for African Hall had grown as important to him as life itself. He would remain nervously silent for a long time, puffing on his old corncob, and then blurt out: "By heaven, Dan! If Mr. Eastman only can see how important—how necessary this is . . . . ." Then he would break off. He wouldn't let himself build a great air castle.

But even though I warned him against killing the goose that laid the golden egg, he could not refrain from aiming at a high figure.

George Eastman was then seventy-one years old. He was a heavy man with an unusually pleasant face and a fine, clear complexion. He was modest to the point of shyness.

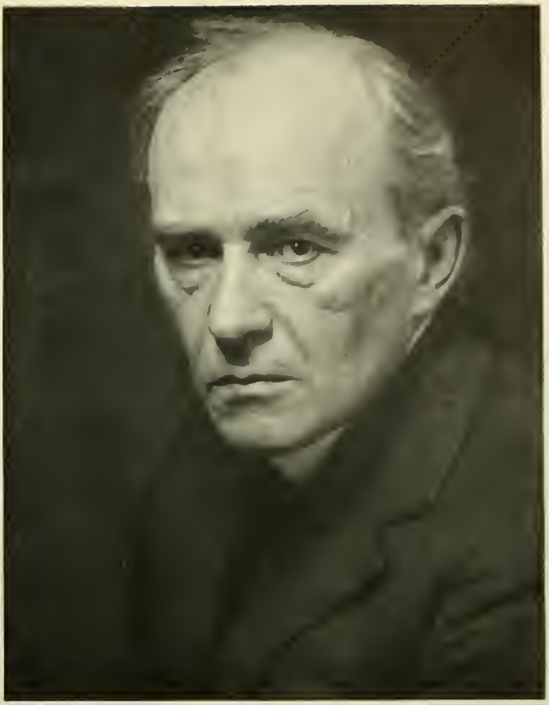
When we talked with him the next day, Akeley painted a word picture of the proposed African Hall, explained that there was no money, and told Eastman that the opportunity was his to create the greatest exhibit in the world. He then asked him point blank for a million dollars.

Eastman said that he could not do that, but that he would give $100,000 to start the thing.

Carl and I had worked out a budget in which the cost of preparing each regular group would be $25,000 exclusive of the expense of securing the specimens and accessories, and the cost of the larger corner groups would be $50,000.

Eastman agreed to stand his share of the expense of an expedition, and his $100,000 would represent three groups—the water hole group, the buffalo group, and the klipspringer.

I told Eastman how generous and thoughtful he was, and agreed to collect and contribute another group myself, the greater koodoo. I said also that my friend Daniel B. Wentz, of Philadelphia, might make a similar con-



A photograph of Carl E. Akeley taken in 1920 by J. H. McKinley

tribution, which he shortly afterward did. We palavered far into the night over itineraries and preparations.

Carl was jubilant. It was the first real break he had had. When we were alone he said:

"Dan, this is the most wonderful thing that has ever happened. At last I begin to see the realization of my life dream. At last!"

We were all, of course, tremendously excited. The expedition which grew out of that meeting was the Eastman-Pomeroy-Akeley Expedition of 1926-1927.

With an encouraging portion of the African exhibits provided for, Carl threw himself with renewed vigor into the task of completing the plan of the Hall. Having pondered over the lay-out for so many years, he visualized every detail. When we departed for Africa he had the whole scheme worked out.

A sad event occurred a month before we sailed. Daniel Wentz, who had agreed to provide the lesser koodoo group, passed away. We carried out his intentions, and the group stands as a memorial to him.

One of the final worries that beset Carl was the rapid extermination of certain of the animals he sought. As Henry Fairfield Osborn had expressed it:

"We palæontologists alone realize that in Africa the remnants of all the royal families of the Age of Mammals are making their last stand, that their backs are up against the pitiless wall of what we call civilization."

The quagga had vanished and numerous other forms were on the verge of extinction. Carl realized that in twenty-five years the development of African Hall would be impossible, for the proper specimens would not be available.

On this expedition in 1926 the recent depletion of the wild life was continually borne in upon us. During a two-day trip down the Tana

River, Carl was dismayed to see how different it was from in 1912, when the region was swarming with game. It was now a complete waste.

Having failed to secure any specimens here, Carl wrote to Doctor Sherwood:

"I have not appreciated the absolute necessity of carrying on the African Hall, if it is ever to be done, as I now do after this painful revelation. *The old conditions, the story of which we want to tell, are now gone, and in another decade the men who knew them will all be gone.*"

Today this crucial situation continues to threaten the success of the remaining groups, and impels us to hasten the gigantic project to as speedy a conclusion as possible. Altogether the Eastman-Pomeroy-Akeley Expedition secured material for ten groups instead of only six as had been planned. And other sponsors have led expeditions and generously provided funds for the preparational work. But we are still confronted with the urgent necessity of securing the support of others who are interested in the world's greatest wonderland of wild life and in this monument to it.

It was this fear of failing irredeemably to secure specimens of the vanishing Africa that drove Carl to such tremendous exertions in 1926.

In the midst of our intensive work in Western Tanganyika he suffered an attack of fever. This prevented him from accompanying me on the quest for the greater koodoo, and he was sorely disappointed. But it was essential that he be taken to the Kenya Nursing Home in Nairobi. In parting, I implored him to guard well his health in convalescence: "Your one aim must be to recover completely. Never mind the time it takes."

I later wired him to have patience, as my own return to America would be indefinitely postponed until we could complete our program of work.

But Akeley was a difficult patient. The King of the Belgians had been eager to send the local Belgian representative, Doctor Dersheid, with Akeley on a survey to establish a game sanctuary in the upper Congo, and Akeley was impatient to get started. On October 14, before he had recovered his strength, the party, including Mrs. Akeley, two members of the Museum staff, and Doctor Dersheid set out. The trip was strenuous.

On November 1 there were many hills to climb, and the heat and humidity were almost unbearable. Akeley became faint and ill and too weak to walk. He was carried on an improvised hammock about four miles, when a thunderstorm broke and it was necessary to make a temporary camp. The next day Akeley felt better and was able to walk into Rutshuru. Akeley was approaching the country which he loved more than any other in the world, and he seemed to be torn between the desire to rest and the great urge to reach the goal.

After about a week the safari proceeded through cold, wet weather to the Rueru camp. Akeley felt very weak, and passed the thirteenth in bed, reading and sleeping.

We have no way of knowing whether he had any awareness of the end. The end came suddenly on November 17, after two and one-half days of exhaustion following the arrival at Camp Mikeno.

Akeley often had said he wished "to die in the harness," and "to be buried in Africa." He died in the country he loved, and was buried in a tomb of solid volcanic rock on the slopes of Mount Mikeno. In Akeley African Hall you can see this mountain in all its beauty in the background of the Gorilla Group.

It is the sharpest sort of tragedy that Akeley should have been taken just at the peak of his great dream. But there is mitigation in the fact that he knew that the great project to which he had devoted his life was to be carried out.

The group of specialists whom Akeley had trained and who had served him in the field—Harry Rockwell, Raddatz, Leigh, Jansson, and others—would carry on the banner, under the guidance of Dr. James Clark, whose long association with Akeley makes him such an expert director of the project.

The work of the expedition on which Akeley died was ample proof of the practicability and extreme importance of his great plan. Action by the Board of Trustees of the Museum came as a direct result of it, and the construction of the African Building was authorized. Soon afterwards it was decided that the building should be a memorial to Akeley.

Akeley bequeathed to posterity a noble gift, the beauty of original Africa, preserved for generations to come. Akeley African Hall is a monument to the royal families of the animal kingdom, and is the symbol of his genius as the father of modern museum display methods.

The Mountain Gorilla Group

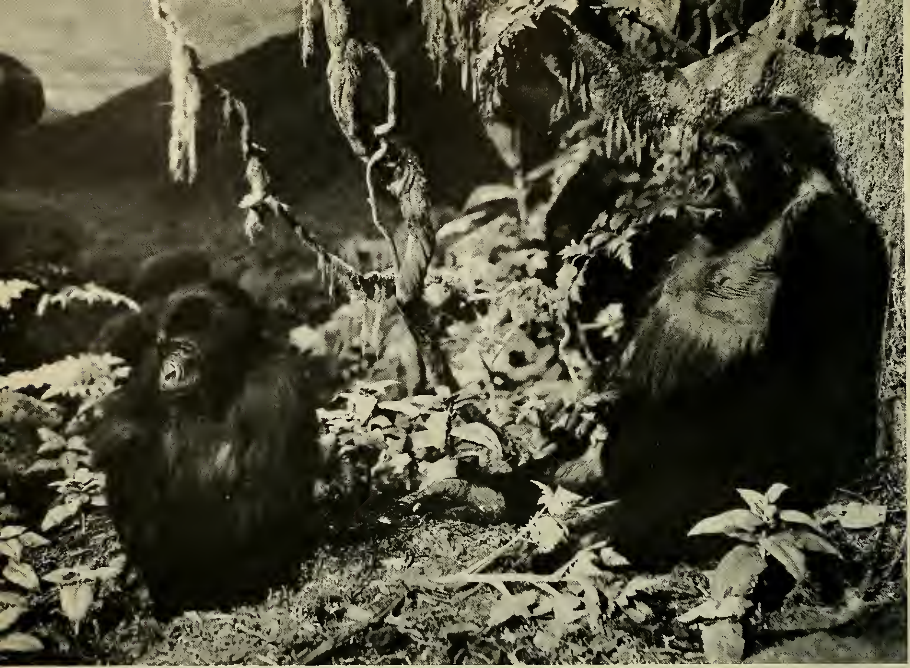
In the following four pages are shown views of the Gorilla Group in the Akeley Hall of African Mammals, which has particular significance because it displays a species in which the late Carl Akeley was most interested. He was engaged upon an expedition to the very locality shown in the group when his work for the Hall of African Mammals was so abruptly terminated by his death. The group pictures a vista of the Kivu volcanoes from the side of one of them.

Shown in this group is *Gorilla gorilla,* the mountain gorilla, subspecies *beringei,* a race confined to the eastern part of the Belgian Congo in Central Africa. Here it occurs from the upper end of Lake Tanganyika northward to Lake Edward, along forested slopes, and eastward to include the Kivu volcanoes. The mountain gorilla is distinguished from its lowland relative, the West Coast gorilla, principally by cranial characters, thicker and darker pelage, and a slight difference in the proportion of shorter arms and longer legs. It is also stated that the two types of gorillas have different habits, that the mountain animal climbs trees less frequently and is more terrestrial.

In the popular mind the life history of the gorilla is commonly associated with the accounts of the early African explorers, Du Chaillu, for example. The gorilla is portrayed as a savage animal ready to charge the hunter on slight provocation. He beats his breast with resounding blows, rushes upon the man who would molest the gorilla family, tears the gun from his hands and bends it into bowknots, and then tears the hunter limb from limb. The observations of Carl Akeley did much to dispel illusions of this sort, and after him a number of other naturalists studied, photographed, and lived with the gorilla to the end that a much better understanding is now possible.

The full-grown gorilla is a powerful animal fully capable of many of the feats of strength ascribed to him, and he is dangerous if crowded too far. Under normal conditions the gorilla is not aggressive and tolerates considerable interference before displaying the danger signs of an active resentment. Usually these animals are shy and flee as soon as they are aware of the presence of man. When pursued, the old male may drop behind and stage a demonstration of rage which is pure bluff. Because of the potential danger of coming to close quarters with an angry male gorilla, the bluff is apt to be quite effective. Under these conditions, the gorilla often uses the thick cover and seems reluctant to face man in the open.

Gorillas are social in habit and the customary group is a family or clan composed of one old male, who dominates the band, and several females, subadult males and youngsters. They are vegetarian in diet and roam through the



Gift of Messrs. Julius F. Stone, George A. Stone, and Franz T. Stone; Misses Edna A. Stone, Theodora M. Stone, and Natalia S. Stone.

Animals *by Carl E. Akeley.*

Background *by Wm. R. Leigh.*

Flora and Foreground *by Albert E. Butler, assisted by U. Narahara, George E. Petersen, George F. Mason, Joseph M. Guerry; Mrs. Mary L. Jobe Akeley, collaborator.*

Direction, *James L. Clark.*

Scientific direction, *H. E. Anthony.*

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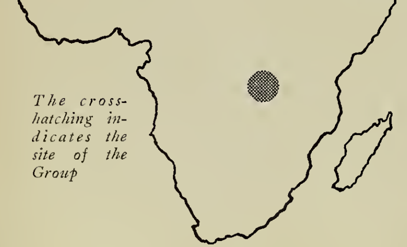
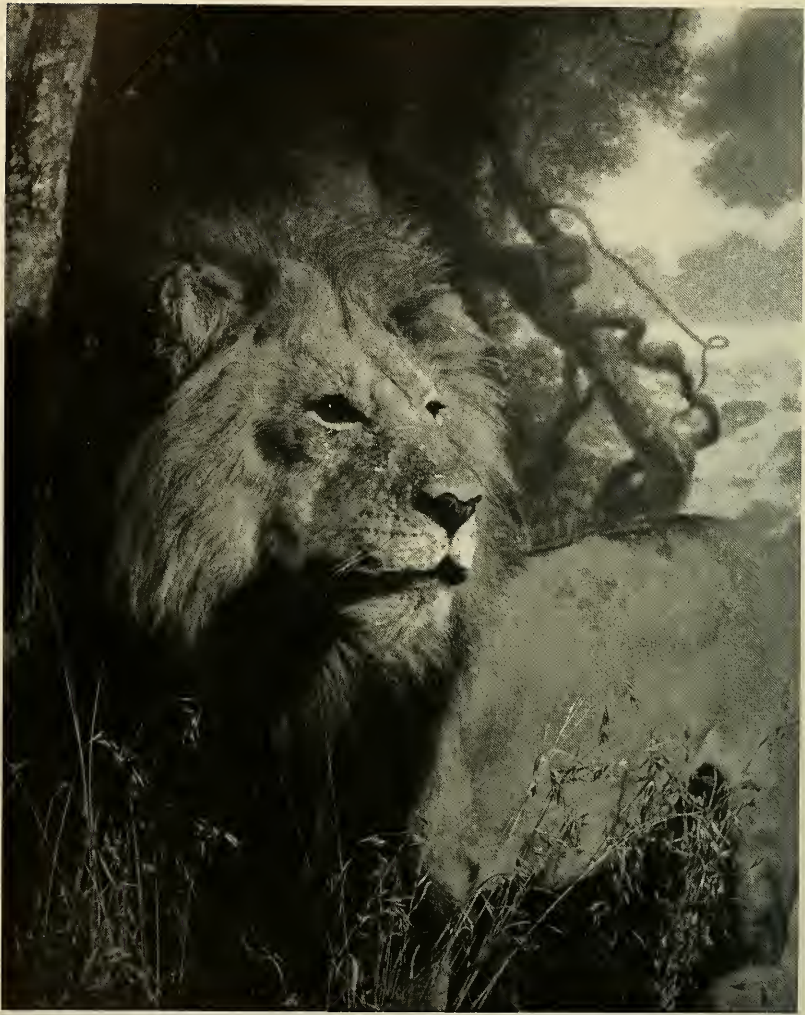
heavy forest growth where they find abundant plant life to their liking. One of their favorite food plants is the so-called "wild celery" shown in the foreground of the group. They are not active at night but sleep where night finds them, making nests or shelters on the ground or climbing up into the lower limbs of trees.

It is not likely that gorillas fear any enemy other than man and the leopard. The leopard would hesitate to attack a full-grown gorilla, but would have no difficulty in overpowering a young animal separated from its companions. Fortunately, the gorilla, both mountain and lowland races, is protected by law throughout its entire range, and in the Parc National Albert the mountain gorilla enjoys complete sanctuary.—H. E. Anthony



The cross-hatching indicates the site of the Group



THE LEADER OF THE LION GROUP

This handsome specimen of an adult male lion was the result of great perseverance on the part of the Carlisle-Clark Expedition. Although two males had already been obtained, the party remained in the field an extra week after all other work was completed until an exceptionally fine animal, such as this one, could be collected.

Large, male lions with good manes are rarely seen in East Africa.

The Lion Group and Its Creation

The beauty of African wild animal life captured and preserved in an American Museum exhibit

By G. LISTER CARLISLE, JR.

MUSEUM expeditions are apt to come into being as the result of the fortuitous meeting of men who have made some branch of natural history their life work and amateurs in natural history. Their interests and activities have made careful observation in the wilds second nature to both and, also, one of the pleasures of living. The Carlisle-Clark African Expedition started in this way from a meeting with Carl Akeley in the American Museum shortly before he left for Africa and his beloved gorilla sanctuary, where he died.

At this meeting it was evident that we held similar views on the high value of museum natural history exhibits in the cause of conservation, or appreciation of wild life and interest in its preservation. Later came happy meetings with Professor Osborn and a fuller knowledge of the needs of the American Museum and of the ambitious plans for the Akeley African Hall which is intended to bring something of great Africa, and its interest, to New York.

A plan materializes

The plans at once appealed to Mrs. Carlisle and to me. We had been in the English Sudan during the previous year and were anxious to return to Africa to experience again the thrill of living in unspoiled country. Thus the expedition which has resulted in the Lion Group was launched. This love of the world as it was in the beginning is deeply ingrained in many of us, and those who have experienced years of life in some one of the few untouched areas count the memory as very precious. There comes as a natural sequence the wish to aid in one of the most important causes of our times, that of the preservation of nature's interest for future generations.

A "conservation" expedition

When the expedition first took form in our minds, much thought was given to the question of whether killing and conserving could be made logically to mix and it was decided that our expedition should be run on a non-killing basis in so far as it was possible and, at the same time, meet the Museum's requirements for group material.

This plan was carried out, and none of us did any unnecessary killing. In fact, Mrs. Carlisle and I did no killing at all.

The outfitting of an expedition is a special field wherein only experience is of value, and we were fortunate in that much of this sort of experience centers in the American Museum. The many expeditions sent out in the past have reduced the problem of outfitting to an exact procedure based on accumulated knowledge—and this knowledge is not one of the least assets of the Museum. My associate in the expedition, Mr. James L. Clark, assistant director of the Museum, carried most of this load and later in Africa gave a lesson in efficient field work which those who accompany him on other expeditions will likewise experience.

Our strong desire was that the Lion Group should embody all excellence that art and craft could give, and, now that the group is completed, we feel our objective has been attained.

By various ways we all reached Nairobi and there met our white hunter or guide, Al Klein, who had been in Africa for twenty years. Klein has been, literally, "in at the death" of no less than a thousand lions, but this is not to infer that Klein, personally, shot that number. As a matter of fact he is opposed to unnecessary killing. Al is not very large physically, and, when we first met, I wondered how all of those lions could have missed him. Later I understood. No lion has yet been quick enough to get to him first, and his deep, commanding voice is a defense in itself. Al is a very delightful companion indeed, witty, and a collector. As a boy, brought up at Haverstraw on the Hudson, he collected birds' eggs. Later his search for bigger and better eggs led him to the dry wastes of southern Africa where a boom in ostrich farming provided a profitable market for the wild ostrich eggs. From there he worked his way to East Africa where with the passing of the years, he has founded a particularly happy home, has became one of the noted East African guides, and he is certainly a raconteur of parts.

Two weeks of hard work awaited us at Nairobi before the equipment was thoroughly gone over and packed in five light motor trucks under a system that permitted of access to at least a part of our equipment without disarranging all of the rest. These were fascinating weeks as the East African plateau has a good climate, and a future, and in consequence has drawn to it many ambitious English who are rapidly building a white man's country astride of the Equator. The natives, instead of being pushed back as the land is occupied, are given large native reserves wherein they live peacefully and without fear of attack from the predatory Masai. The treatment of the natives in East Africa and in the Sudan is wise, just, and definite, and well may England be proud of her Oxford and Cambridge administrators.

The "D.C.'s"

Meeting and knowing the English District Commissioners, or D.C.'s, as they are called in the Sudan and East Africa, is a major pleasure. Their lives are full of vivid experiences, many of which turn on personal courage and confidence in their own ability to settle tribal disputes fairly and quickly without resort to force. As a necessity they must know the native language, and the native customs which serve as native laws, and their aim is to render verdicts in their local courts in accordance with tribal ways. Strong attachment and loyalty generally characterize these natives in their relations with their British leaders. England rules her East African Colonies with marked consideration for the happiness and material welfare of her native subjects. Many white colonists in Kenya even think that too much consideration is given them but, be that as it may, the result is that England is enabled to rule her East African Colonies with a mere handful of white troops. What the future may hold, however, is obscure, as the outcome of the present Abyssinian situation may profoundly influence English interests in East Africa and the Sudan, and there are even wider possibilities.

Game commissioners

The game commissioners of East Africa are splendid men, often retired army officers, and their control of hunting is very much more effective than any hunting control known to us in America. In East Africa the game laws are obeyed, or retribution is swift and adequate. On his return from safari many a hunter has been surprised at the "news value" given by the game commissioner to certain supposedly unknown incidents that occurred out in the Blue. There must be an "underground telegraph" or a "grapevine system" supplying red-hot information from the field, as the game commissioners know all that happens on an expedition, apparently, as soon as it happens.

The East African plateau is interesting country, with its several high dominating mountains, its hills and grassy plains, its Rift Valley and high escarpments. We crossed the Rift Valley soon after leaving Nairobi, and it is, perhaps, the most outstanding geological feature in Africa. Imagine, if you will, the Highland area of the Hudson without a river flowing in the trough and, after adding length, ten miles to the width, and two thousand feet to the height, the comparison will reasonably apply to the valley at the point where we crossed it. But the genesis of the two valleys is so different. The Hudson Valley was eroded by water, bit by bit, while the Rift Valley was formed by the subsidence of the block between two roughly parallel faults, and the amazing fact is that the Great Rift Valley systems extend from Northern Palestine to southern Africa and embrace several of the larger lakes such as the very deep Lake Tanganyika. Lake Baikal in Siberia is another long, deep lake, formed in this unusual manner. It was really thrilling even trying to understand the geology of the area as we descended the steep eastern escarpment where, incidentally, grow the world's largest cedar trees. Game or no game, and there is generally some in sight, travel in East Africa is full of incident and food for thought.

We were traveling southerly from Nairobi in Kenya toward the plains area in Northern Tanganyika where there is the last great concentration of animal life likely to be found anywhere in the world. This was Carl Akeley's opinion, and the more I think of it, the happier I am that we did so little to disturb that wild animal zoo which, fortunately, has now been made into a closely guarded game refuge.

Reaching the lion country

Our guide, Al Klein, was heading for a little grassy swale on the side of a certain wooded hill overlooking the plains—now pictured as the background in the Lion Group—and he was quite keen about getting there privately. Al is noted for his good judgment in the selection of hunting country, but he does not believe in advertising. Our desire was to reach the site of the proposed base camp in such a manner as to prevent others from following our trail. This important maneuver added three days to our journey, but it was worth it!

We were then in real lion country—and alone—and thereafter we saw from two to twenty lions daily, some duplicates no doubt, as there was plenty of game in the area and no need for the lion to travel far in search of food.

As soon as our base camp was established in the center of the best lion country on earth, we began our inspection of the local lions and hunted tirelessly for individuals suitable for the proposed group. Our group was to be real in every way, an artistic and truthful reproduction of an East African scene, and the amount of work involved in the consummation of such a project is little realized by the casual visitor to the museum. Groups may be made from a hunter's imperfectly cured skins and his recollections of the surrounding country; but the Akeley Hall is different. Using the Lion Group as an illustration, we have there an exact and artistic reproduction of East African lions and of the hills and grassland where they live and hunt. At times single lions are encountered but generally more. In fact, on one occasion I saw sixteen together, but in this part of East Africa they usually live in small family groups similar to the one represented in the Akeley Hall. The modeling is based on intensive study of the animal, on a scale model of the group made in the field (an unusual refinement), on detail measurements, and on plaster casts of the lions taken after the skins had been removed. Even the skeletons were preserved in order that they might be used in the modeling process in the American Museum.

Getting skins out of Africa in perfect condition for mounting requires knowledge and equipment and ours were delivered at the Museum in hermetically sealed poison-gas tanks in as perfect condition, I dare say, as any ever brought in. I am especially proud of this phase of the field work.

Successful lion groups are very difficult of accomplishment owing to the facility which the animal has of expressing his feelings and, after seeing my first hundred lions, I realized that the success of the group would depend on the ability of the sculptor. We have all seen poorly mounted lions in museums, but ours were to be different, and they are different—thanks to the ability of Mr. Clark.

The foreground of the group is as real as the animals, and most of the accessories in the group were actually brought from Africa. The fine background painted by Mr. W. R. Leigh is so true to the actual African scene which it reproduces that it refreshes my memory picture even to the small details. He made some twenty delightful oil paintings in Africa and from them the finished background was evolved. Few museum expeditions take artists into the field, and this is to be regretted, as their field "sketches" are necessary in the painting of a true reproduction of a wilderness scene.

Rich fields for the artist

Some expeditions to Africa have as their object hunting, others collecting, others photography, but few go to Africa merely to paint the vanishing wild-life in its native setting. This is rather strange when one considers how few good paintings exist of the old game herds once so numerous on our western plains. Today even the work of poor painters who lived in our early West is treasured in museums, while little effort is being made to preserve the present Africa game scene on canvas. Such pictures will be invaluable when time has destroyed the motion picture film. I can imagine nothing happier than a return to Africa with Mr. Leigh in order that he might make a series of game paintings; he is a talented animal painter as well as landscape artist. I am only sorry Mr. Leigh was unable to paint in that baboon fight we saw in the original setting. It was a family fight and noisy as usual, and there must have been forty in it.

Extra effort rewarded

The selection of the particular lions desired for the group was Mr. Clark's special province and he, therefore, did the collecting. The largest lion in the group is the young male behind the tree, and he was taken on the plea of some Masai tribesmen who reported that this particular lion had killed one of their steers during the previous night. The big-maned male was a find at the very end of our safari, when an extra week was allotted to an intensive search for a better specimen than we had so far collected.

Lions differ somewhat in characteristics as their habitats vary. From the Cornwallis Harris illustrations made before 1840 it would appear that the Cape lion, now extinct, grew a more luxuriant mane than the East African, and the Abyssinian lion, I believe, although smaller in body, also has a fine mane. The East African lion has a fair mane, and the group contains the best specimen encountered during three months in the field—with the possible exception of one that was too quick for us.

One cannot live in East Africa without acquiring a deep interest in the lion and his long rule over the country, and yet he lives dangerously. At times he is injured in killing; two of the lions we killed carried evidence of such injury and were not used in the group.

We came on one of these lions unexpectedly as he was lying by a water hole in a beautiful grove surrounded by a great troup of barking zebras—all maligning him terribly. The zebras were making a wild woodland protest to the well understood determination of the lion to kill a zebra before he would permit the rest of the herd to touch a drop of the precious water. After enjoying the strange and noisy scene for a while, we decided that the lion was better than any we had, so he was shot, but it was afterward discovered that he was unable to make a kill owing to injuries and, in fact, he was partly paralyzed in the rear. Presumably he had been injured in killing one of the larger animals able to put up some defense against his usually deadly method of attack.

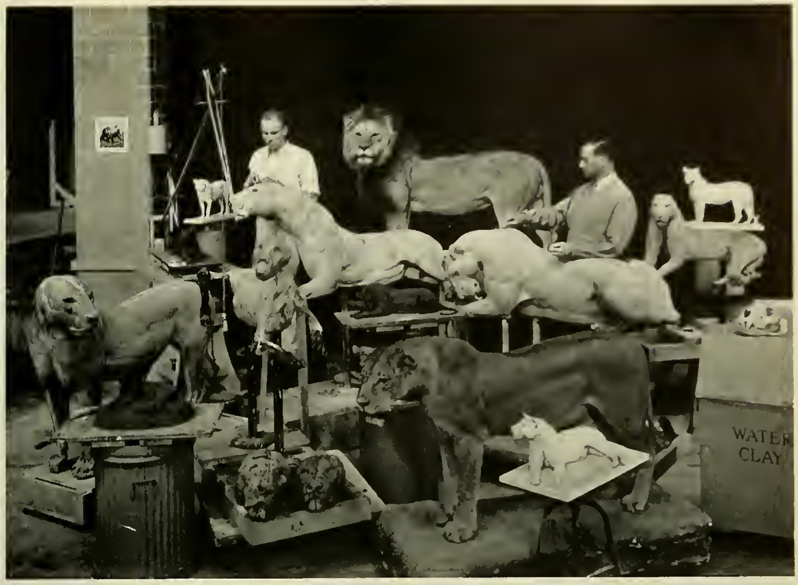
If the quarry is small it may be struck down by a stroke of the lion's paw—and I have seen this done in the killing of a reed buck. However, where capture depends on the speed and weight of the lion, the animal attacked should have strength and size sufficient to hold up the lion long enough to break his fall. Zebras are often killed by lions, and the size and strength of the zebra, as well as his meat, may just meet the lion's requirements.

This September morning here in Connecticut I looked out of my breakfast-room window and saw seven wild deer. Two of these were undersized and in poor condition and I doubted whether they would get through the coming winter. In Africa it is different. There the lions and leopards pick off the laggards, the weak, and so aid in preserving the health of the herd. As I saw them on the Serrangetti plains they fairly radiated vitality, and few die of old age.

Those African evenings around a big fire, as notice to the lions as well as for warmth, were grand affairs. Delightful tales of Africa were continually punctuated with wild noises. The late afternoon peace of East Africa is made vocal by the cooing of the wild pigeon, but after his all pervading song has apparently lulled the wild things to sleep, then the killing begins. Later one listens to the grunts and deep-throated roar of the lion, to the curious cough of the leopard, perhaps prowling in the blackness just beyond the circle of light, and to the weird yell of the hyena—all telling of the content which follows the satiation of their wild hunger.

The venture proved absorbingly interesting. The carrying out of an American Museum Mission is a rare pleasure and, I may add, a privilege, and you, reader, may also desire to aid in this interesting work. There are still important groups to be procured for the Akeley Hall.

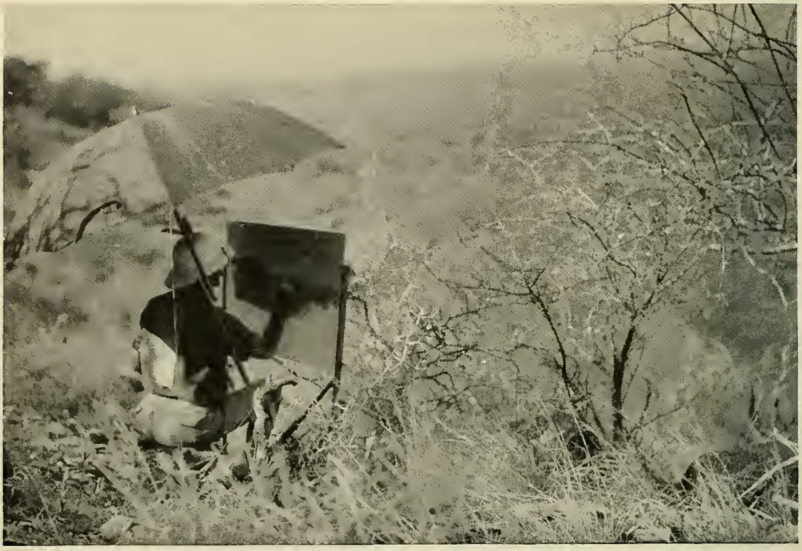
I would like to add that hunting and collecting are different, and it will be well to do one or the other, but not both. Also, it will be but fair for you to arrange for the completion of your work at the Museum, after you have had the fun of the field expedition.



(Above) A lion group in the making. The animals obtained in Africa being brought to an appearance of life in the preparation department of the American Museum. A picture of the finished group will be found on page 40.

(Below) A group of lions as they are most frequently seen in east Africa. They tend to group themselves into families except for the old males which usually roam about by themselves.

Photograph by
Martin Johnson



Mr. William H. Leigh at work in the field on color sketches to be used later for the background of the Lion Group. His gun-bearer, and protector if necessary, is just behind him, but out of the picture. An artist cannot concentrate on his work and safety at the same time.

The Carlisle-Clark Expedition preparing to leave Nairobi. Systematic packing is very necessary as the unexpected generally happens during field work in Africa

Mr. Leigh at work on the lion group background in the African Hall at the American Museum. Few visitors, when viewing the finished work, will realize the amount of thought, effort, and skill that has gone into the making of the backgrounds

The end of three days' hard work. Some real road building was necessary when the heavily laden expedition auto trucks became stuck in a dried watercourse

(Above) African travel made really interesting by an unexpected rain at the beginning of the dry season. This river was flooded to a disconcerting height, considering the fact that it was necessary for the expedition trucks to cross through it en route to the Serengetti Plains. (Below) The Carlisle-Clark African Expedition returning to Nairobi after a three-month's collecting trip in the most interesting game country left to the modern world.

Some African Hall Chronicles

A saga of the collecting expeditions behind the groups

Although the visitor to the Akeley Hall of African Mammals may well be impressed with the meticulous artistry of the habitat groups, there is a story behind each group that represents as great a task as the making and assembling of the groups themselves.

These chronicles are the sagas of the expeditions that spent adventurous and arduous weeks in securing the fine specimens which represent African fauna and flora at its typical and best.

The foundation laid

The foundation for African Hall was actually laid when the Eastman-Pomeroy-Akeley Expedition set out for Africa. It was on this great safari, led by Carl Akeley himself, and supported most nobly by Messrs. Eastman and Pomeroy, that the main groups were obtained. The animals of the Plains Group and the great Water Hole Group were selected and hunted, as well as the greater and lesser koodoos, the klipspringer, the impressive buffalo, the wild dog, bongo, and impalla.

Much has been written on this famous expedition in the books of Mary Jobe Akeley, and the reader of this issue of Natural History will find it described in the articles of Daniel Pomeroy and Martin Johnson.

Mr. G. Lister Carlisle has also written for this issue a typical account of one of the African Hall expeditions so full of adventure and scientific interest. To avoid a natural repetition and to place before the reader in as concise form as possible the accounts of the several expeditions which contributed to this great monument to African wild life, the following excerpts from field records are given to show some of the dramas behind each group.

When the O'Donnell-Clark Expedition set out in January, 1931, to obtain the specimens of the giant eland of Southern Sudan, they realized that they were setting themselves a task similar to "looking for a needle in a haystack." Lesser eland were to be found over Southern Africa; but the giant eland, a great, shy, handsome animal, was to be found only in two small and widely separated districts. Since the Sudan range was more accessible, the expedition, consisting of Dr. James L. Clark, C. Oliver O'Donnell, W. T. Hunt, John W. Hope, Dudley Blakely, and Jack Robertson assembled at Khartoum in February of that year to outfit their expedition. From there they sailed up the Nile 860 miles to Shambe, a little river station, from which outpost they were to set out for the back country in search of the elusive giant eland.

"Deserving your eland"

Little or no information about this giant antelope could be found in Khartoum or farther south than the Sudan since few people, even among the local officials, had hunted it.

They were told in Khartoum, "If you get your eland, you will have very well deserved them." With this scant information and with hints as to their whereabouts picked up by Doctor Clark some years before, the hunters proceeded one hundred miles westward from Shambe to Rumbeck. There they were advised to go another fifty miles farther west to a spot known as "York House." This regal name was applied not to a mansion or stately outpost, but a simple grass hut by a water hole where the Duke and Duchess of York, on a previous visit, had established this camp to try for lions.

There the O'Donnell-Clark Group by good

luck jumped the only herd in the country, on their first day. Their good fortune, however, was only of eight hours' duration for, after trekking the herd for that period of time, not a single chance of a shot presented itself and the herd moved on into the wilderness.

The heat was so extreme and the conditions of living were so bad there that the expedition set out the next morning for Amadi Post where they again reassembled and proceeded sixteen miles out to one of the rest-camps which was assigned to them by District Commissioner Cann of Amadi. Several days of hunting disclosed nothing but a few old tracks of a herd that had long since passed that way. As Doctor Clark wrote in NATURAL HISTORY, November, 1931: "After seeing this eland country, I began to realize the great part luck would play in our success, even though we hunted hard and conscientiously. The first thing was to locate the eland; second, to see them first; and third, to see enough of them to pick the desired specimen."

A limited privilege

The expedition possessed licenses to shoot only two eland. At least four would be needed for the group and the extra two were subject to a fee or "export duty" of five hundred dollars a head. With a misplaced shot costing five hundred dollars, their difficulties became intensified.

In this country thickly but evenly covered with small trees and bush, no long vistas could be found—about seventy-five yards was the length one could see on the average. A switch of a tail, the movement of a single ear suddenly come upon was all that could guide them. The eland never stop to feed. The herd travels zigzaggedly only to reach for leaves or to break down with their horns the small trees which bear their food.

After three days in such difficult country, the bearer spotted a herd of eland during one of their trips, but before they had time to sight an individual animal, the herd had their scent and were off. The next day and the day after they hunted in different directions and devoted what time they could to the collecting and preserving of accessories while O'Donnell hunted by himself for three days. Two weeks had now gone by, and still no eland. Then one day fresh tracks were seen of a single animal. Carefully they trailed him but always he eluded them in the heavy grass and thick underbrush. A second track was found and as they stopped to examine it their guide sighted the herd—or what they hoped might be the herd. About 150 yards to their left there was part of an eland visible through a spot in some thick bush. Doctor Clark dramatically tells of its capture.

A dramatic capture

"Here we were—clean in the open, with hardly a blade of grass to shield us. How we had gone this far without being detected and how the shikari picked up this tiny spot is one of those breaks in hunting that can't be explained and which we call 'luck.'

"I looked through my glasses, but all I could see was a single spot of tan. I could not distinguish just what part of the animal it was, but I was sure it was an eland. Then to the right my eye caught the swish of a tail. This gave me his general position, and looking at the other side of the spot, I saw the tip of a horn. Everything else was a wall of leaves.

"Apparently he was facing left and almost broadside. Fortunately the same leaves that shielded him also shielded us from his view.

"Although I searched the bush for others, not a sign could I find and I turned again to study his position. At last I had an eland before me, but was it what I wanted? I suspected I saw the tip of the other horn, and slowly edged my body sidewise to locate the head, if possible. I saw a big ear swing into view and from its position figured he must be looking our way, yet I could see no part of the face and not until this ear changed its position did I dare to move. When the ear swung back, a tip of horn came into view and from this I finally put together the puzzle of his head.

"The patch we saw was part of his shoulder and from what I saw of the tip of the horn I figured it was undoubtedly a bull, but was too small for the group. At one time I decided to let him go and to try for a bigger one. Then I began to reflect upon the days I had trod the ground with never the sight of one, and here was my first chance, the only shot I had had presented in all the fifteen days of hunting. Finally I said to myself, 'Don't be a fool. Here's a bull eland, and you may never see another. Take him!'

"I could see the point of the elbow and a bit of the brisket and from these I judged the position of the heart. Cautiously I changed my glasses for my gun and slowly brought myself to a sitting position. Now I was ready to shoot.

"With my mark spotted more by the bushes than by the now indistinct body, I took aim, but I was inwardly too excited, and the front sight would not settle down to quiet. I began shaking like a leaf. I was getting buckfever. I dared not risk the shot, so I took the gun from my shoulder.

"It was with supreme effort that I recollected my scattered nerves and calmed myself to steadiness. Then, holding my breath, I began to squeeze the trigger as I held the gun with braced elbows on my knees. It finally went off and at the report I saw the animal jump and a pair of heels fly into the air. Somehow I was confident, but rushed ahead to follow through.

"When I neared the spot, I saw through the bush my eland lying motionless and, to my great surprise, there stood two more fine bulls but a few yards away. Startled by the ring of the shot and their comrade's fall, they stood and watched me. Hurriedly I looked them over. I had by sheer luck drawn the best."

The task not ended

The camp was a happy, buoyant place that evening. Although another full week was wasted going and coming from other eland grounds farther west, without sight of another herd, the hunters toiled on. They were to sail from Shambe on April first and the days had sped by until it was now March 29. They had hunted a total of 220 miles on foot and had not seen another herd from which they might hope to get an eland cow for the group. Food was about gone, for things had been timed to wind up on this day. On the morning of the 29th the gray, dull light and recent rains made ideal hunting weather. For two hours they skirted the country about their camp where they had gotten their first bull. Suddenly they sighted a herd coming straight toward them, but again their problem presented itself. But one shot was possible and that would have to be a cow. Just a few steps in front of the hunters one such animal raised her head. A slight turn to the left and she presented her shoulder just as Doctor Clark pulled the trigger. She was so close that with one lunge she could have pinned him to the ground. As the shot rang out confusion reigned and eland broke in all directions. The cow wheeled, but another shot brought her down for good.

The O'Donnell-Clark expedition had found their "needle in the haystack."

The sable antelope

The magnificent Sable Antelope Group was obtained by the Vernay-Angola Expedition.

Although they were obliged to hunt these animals during the dry month of August, when tracking was most difficult, Mr. Vernay succeeded through persistence in shooting the splendid specimens that are now in African Hall. After three days' reconnaissance in the sable country, Messrs. Vernay, Lang, and Boulton made their camp on the Teti River not far from the salt pans near Chisongue.

"I had with me young Alan Chapman who was born in Angola," wrote Mr. Vernay in NATURAL HISTORY in November, 1927, upon his return from Angola.

"It was for his grandfather that the Chapman zebra was named. Our plan of attack was that Alan should go north and I south, he go west and I east, or whatever arrangement might be best so that we should cover the whole country as much as possible. The first day out I was rewarded by getting two cows, one old cow and one young cow who had had one calf. The next day a calf was the bag.

"Two days after that Alan obtained a young bull with 39-inch horns. And time went on—and our anxiety increased as we now had only three days left; I decided to send Alan to camp on the Tunda River, which was about fifteen kilometers away, as only a few days before I had seen tracks of a large bull which I thought he might possibly find. In the meanwhile I covered another part of the country. The understanding was that he was not to return until nine o'clock of the morning we had to break up camp. This would allow him a few hours after daybreak to make a final hunt before reporting.

"I had no news from Alan, and finally had only one day left. After having made a fairly thorough inspection of the country, I considered it almost useless to go out the last day—the natives' feet were in bad condition and we were all tired—but finally I decided that we would make one last attempt and make a big detour around a feeding ground where I had seen a large bull at dawn a few days previously.

"I started out at a quarter to five with Sakafuta, an Ombundu native, and one other. At a quarter past seven I saw to the left, about 150 yards in the bush, a magnificent bull sable walking majestically through the bush, returning from the feeding ground. Sakafuta and the other native had not seen him, as they were looking in the other direction. However, at a signal, they immediately went down on the ground and disappeared in the grass, which was up to our waists. The bull in the meanwhile disappeared behind a large dead tree which had fallen. It was an anxious moment, wondering whether he would keep on or possibly turn away into the bush, which would mean that I should have to move and he probably would see me. However, he fortunately came out from behind the tree and was shot. In this way a magnificent specimen was obtained, which complemented the group of the sable antelope."

A foretaste of what the American correspondents are experiencing in Abyssinia was obtained by Morris and Sydney Legendre, Gertrude Sanford, and T. Donald Carter when thy set out to secure specimens of the Abyssinian nyala—"The Queen of Sheba's Antelope"—in 1929.

Camping out in southern Abyssinia provided plenty of thrills and the elusive nyala. Mr. Carter and Sydney Legendre each secured a bull and Sanford secured two does. As they describe the shooting of the first big bull, "He was sighted a little after sunrise, and was followed all day, yet, although he was always kept in sight, he was never close enough for a shot. At sunset he seemed to disappear altogether. Suddenly, just as the party was about to return to camp defeated, he appeared silhouetted against the sky. The range was rather long and the light practically gone, but as it was their last chance, they decided to shoot. The first shot, a lucky one, dropped him in his tracks.

"In one day Mr. Carter had six animals to skin out and care for. The natives helping him were practically useless. Doing very little, they nevertheless managed to do it carelessly, so that he was forced to go over everything they touched. Often he worked a day and night without stopping, and it is due to his untiring efforts and skill that we were able to bring back to the Museum the skin of every animal we shot."

Mary L. Jobe Akeley

The chronicles of African Hall would not be complete without mention of the earnest participation of Mrs. Mary L. Jobe Akeley and her constant enthusiasm which has brought substantial support to the project. The reader is referred to Mrs. Akeley's books for further information, and to volumes xxv, xxvii, xxix, xxx, and xxxi of NATURAL HISTORY which carry other stories of African Hall expeditions.

A Pre-View of Eight Groups in the Akeley Hall of African Mammals

The following photographs were selected to give some idea of African mammal life as it will be displayed upon the opening of the new hall to the public early in 1936.

Although the hall will not be completed at that time, enough of the large and spectacular exhibits will have been finished to warrant admitting the public. All of these completed groups are to be found on the second floor of the African Hall, but progress on the third floor, or balcony, justifies the prediction that some of those habitat groups as well will soon be available to the visitor.

The photographer in his selection of the details to be pictured and in the use of special illumination has achieved results which speak for themselves, but it is impossible to do full justice to the beauty of the groups through the medium of photography, and the visitor should find these transplanted portions of Africa exceeding any expectations aroused by the photographs.

All of the groups in the Akeley Memorial African Hall have been assembled under the direction of Dr. James L. Clark, and the scientific direction of Dr. H. E. Anthony.

Text by H. E. Anthony
Photographs by Wurts Brothers

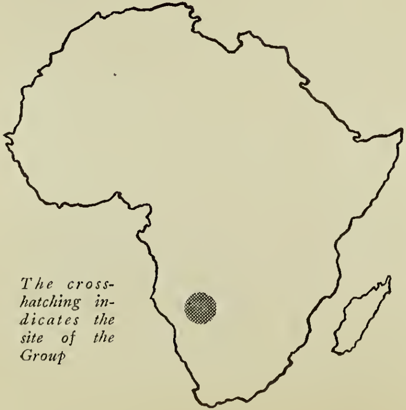
The Giant Sable

GIFT OF MR. ARTHUR S. VERNAY

ANIMALS *by John W. Hope.*

BACKGROUND *by C. C. Rosenkranz.*

FLORA AND FOREGROUND *by Albert E. Butler, assisted by George F. Mason and Joseph M. Guerry*



The cross-hatching indicates the site of the Group

THE giant sable (*Egocerus niger variani*) with its fine, upstanding carriage, its impressive, curving horns, and its appearance of alert awareness is one of the most spectacular of all the antelopes. The members of the genus *Egocerus* (sable and roan antelopes) stand relatively high at the shoulder and have the appearance of being up on their toes and ready to go.

This physical appearance of vigor and watchfulness is well supplemented by sharp senses, the power of vision being especially keen, and by a disposition unusually aggressive for an antelope. The sable is one of the very few antelopes that will, when wounded, charge man.

The sable antelope shown in the group, the giant subspecies, sometimes called Varian's sable or the Angola sable, is to be found only in Portuguese West Africa, in Angola. Other races of the sable antelope occur from the Transvaal and Rhodesia north to Tanganyika and Kenya. Unfortunately, the giant sable has been so reduced in numbers that it is not far from extermination. Habitually, the sable antelope runs in small herds, although an occasional old bull may be observed traveling by himself. Such individuals usually are extremely wary. Captain Gilbert Blaine, an authority on Angola, states that he has not noted the giant sable occurring as a solitary old bull, but has found two young bulls, probably driven out of the herd, traveling together, very shy and watchful. According to his experience, the sentinel for the herd will be a young bull. It is said that formerly, in South Africa, the sable traveled in bands of as many as fifty or sixty animals, but today the sable of Angola may be found only in much smaller groups. Usually there is but one large, mature bull with a herd of cows and young animals, although the sexes will be about equally divided. Half-grown bulls with much smaller horns will be tolerated by the herd bull.

The giant sable prefers brushy plains, lightly forested stretches, or low, hilly districts. It does not wander far from areas of at least scrub vegetation and is not found out on the open stretches of the great Kalahari Desert. It comes regularly to water and is least active during the heat of the day.

At the time Mr. Arthur Vernay collected the specimens shown in this group, August, 1925, the giant sable was already becoming scarce. Mr. Vernay experienced no great difficulty in getting the cows, calf, and young bull, but could not locate a big male, one with horns more than fifty inches in length. By the fortune of the chase, the big bull was secured on the last day of hunting before Mr. Vernay had to leave Angola. Luckily for the Hall, this individual had truly magnificent horns. Although not a record, a head as large as this is an achievement for recent years. The dwindling numbers of giant sable, the fact that they are limited in their range, and that hunters are eagerly seeking the big heads, all operate against the production of horns as large as those of former times.

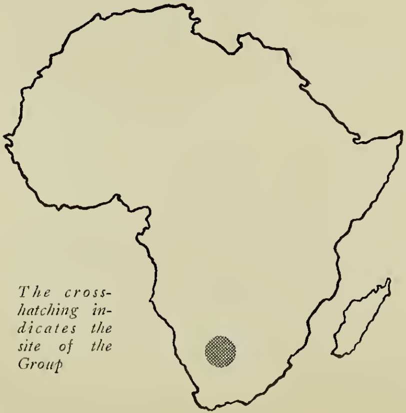
The Gemsbok

GIFT OF MR. ARTHUR S. VERNAY

ANIMALS *by Robert H. Rockwell.*

BACKGROUND *by Dudley M. Blakely.*

FLORA AND FOREGROUND *by Albert E. Butler, assisted by George F. Mason.*



The cross-hatching indicates the site of the Group

THE gemsbok (*Oryx gazella*), sometimes anglicized to gemsbuck, is the largest of the genus *Oryx*, the group of antelopes carrying long, slightly curved horns. All of the *Oryx* are handsome mammals with compact bodies, businesslike horns, and rather showy markings; and at the top of the list stands the gemsbok.

This antelope shows a preference for desert areas and is at home in southwestern Africa from the Kalahari Desert to the northern limits of the Cape Province. Because of its specialization for a desert environment, its ability to obtain the water it needs from the vegetation upon which it feeds, more particularly a variety of wild melon, and the inhospital character of these desert regions for human occupation, the gemsbok has not, until recently, suffered unduly from persecution by man, and still exists in numbers over much of its range. The advent of the motor truck, carrying a water supply, has brought a menace to the mammal life of the Kalahari, and the gemsbok has already begun to suffer from this attack upon its natural sanctuary.

With the gemsbok, as with other *Oryx*, the horns of the female are longer although not as heavy as those of the male. A maximum length of four feet along the curve is recorded for this antelope. The spearlike nature of these horns makes them formidable weapons and the gemsbok is an aggressive believer in their use. When wounded, it does not hesitate to charge the hunter; it is said that it successfully combats the lion; and during the rutting season the males fight savagely with one another.

In common with other plains types, the gemsbok has very sharp vision but seemingly places most reliance upon its sense of smell. These antelopes do not travel in large bands but rather as solitaries and groups up to six or eight in number. A bull may have two cows as consorts and, with the young animals and immature bulls, the family group may hold together to reach this figure. The solitary gemsbok are apt to be old bulls which, because they have no companions to do a sentinel turn, must be continually on the alert themselves and are accordingly difficult to approach.

Despite a general lack of water on the Kalahari and the fact that it is truly a great desert, there are considerable stretches of scrub vegetation and occasional "pans" where water may be found at certain seasons of the year. The mammal life of the Kalahari comes to these "pans" for water when it is available, but the observations of men who know the region indicate that the gemsbok wanders at will and need not base its choice of range upon the presence of water.

The name suggested by the early Dutch settlers for this sharp-horned antelope gemsbok, is rather peculiar when one considers its original meaning. The Dutch called the chamois a "gems" and the English equivalent of "bok" is buck, so "gemsbok" means a buck chamois; but there is very little about the African species suggestive of the small antelope of the Alps.

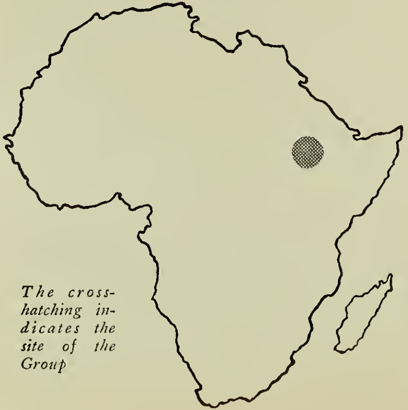
The Mountain Nyala

GIFT OF SANFORD-LEGENDRE EXPEDITION

ANIMALS *by John W. Hope.*

BACKGROUND *by C. C. Rosenkranz and Dudley M. Blakely.*

FLORA AND FOREGROUND *by Albert E. Butler, assisted by Dudley M. Blakely.*



The cross-hatching indicates the site of the Group

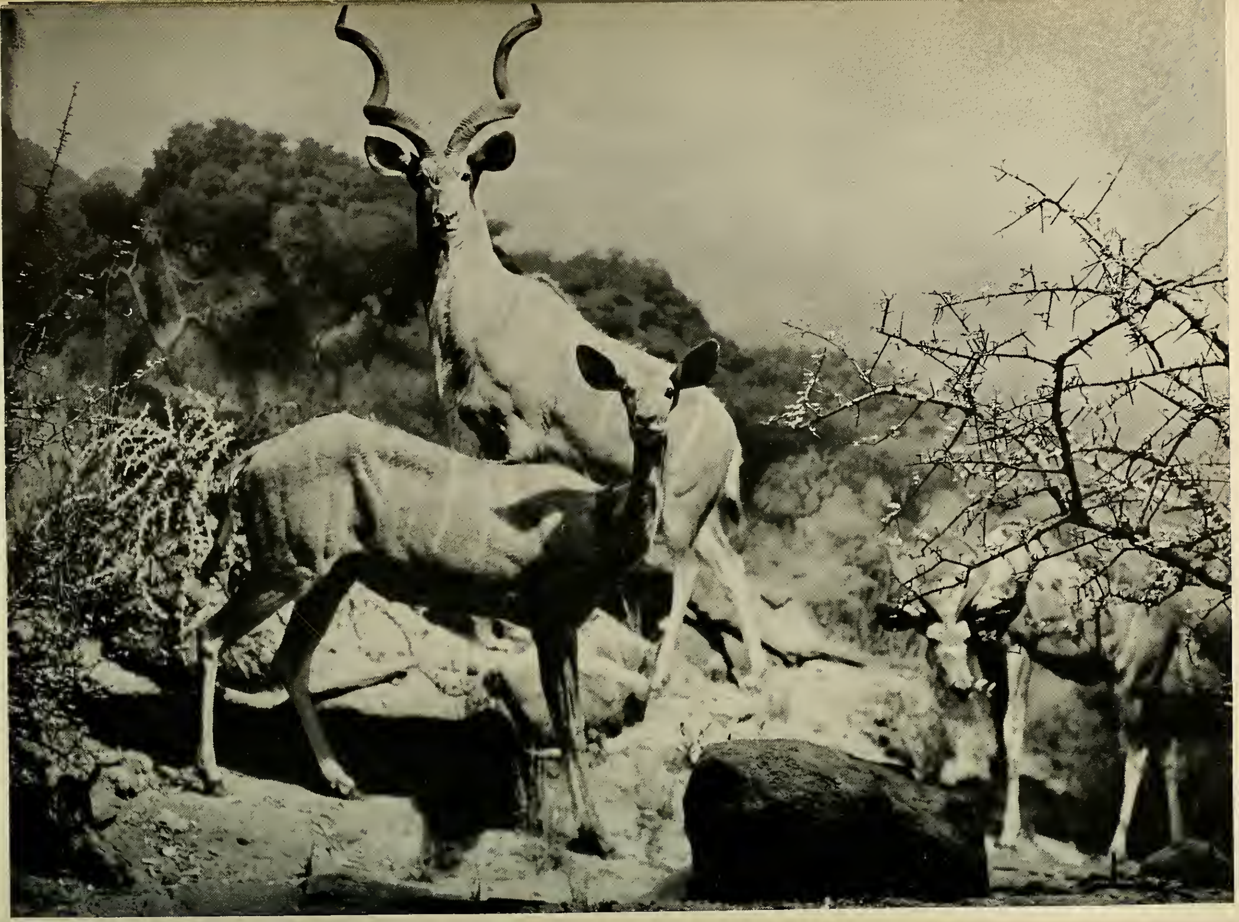
THE mountain nyala or mountain bushbuck (*Tragelaphus buxtoni*) is found only in the mountainous corner of Africa occupied by Abyssinia and even here it is restricted principally to a small area centered about the Arusi district. It is, as its name suggests, a bushbuck that has come up from lower elevations, adapted itself to a high altitude environment, roughly 9000 to 14,000 feet, and has retained the same type of twisting horn. It is, however, much larger than its lowland relatives, carries much heavier horns, and is a much more impressive animal. One of its names, the Queen of Sheba's antelope, indicates its importance among the game mammals of Abyssinia.

This antelope feeds on the high mountain slopes and rolling uplands where the dominant vegetation is giant heather. It is also found in the forest which lies along the slopes before the zone of heather is reached. In this forest bamboos are a prominent feature. This is a region of temperate characteristics in that nights are cool, often with the thermometer dropping to the freezing point, and precipitation is sufficient to encourage green vegetation. At midday the sun may become quite hot, thus causing the daily range of temperature to cover a wide swing.

The mountain nyala occurs singly or in small bands up to six or eight in number. Apparently the total number of this species is not very great, for the animals are local in distribution and restricted rather closely to a specialized environment. Fortunately for the preservation of the species, it is not convenient for the average hunting party to make the long and difficult trip up to a timber line so removed from railroad or motor transport. Accordingly, few white hunters seek the Queen of Sheba's antelope.

During the hours of high sun the animals are in the forest or thickets and then wander out into open patches late in the afternoon. Here they feed, browsing on heather principally, although grazing occasionally upon grasses, until sunrise of the next day. Mountain mists sweep the slopes at times and serve to protect the nyala from the vision of the hunter without handicapping the antelope to any great extent, because the latter rely upon a keen sense of smell. It is said that when out in the open, they are noticeably more shy and wary than when among the trees, and if pressed too closely, they may climb above the heather into the barren, open terrain of the mountain-tops where they have a decided advantage over any pursuer. Lions do not occur in the region where the mountain nyala lives, and the leopard is not common there; hence these antelopes have little to fear from any creature other than man.

This antelope is related to the nyala (or inyala) of southeastern Africa, a handsomely marked representative of the bushbuck family. The similarity of names is confusing, but the inyala has smaller horns and lives along river banks in the lowlands. Still another name for this southern nyala is Angas' bushbuck.



The Greater Koodoo

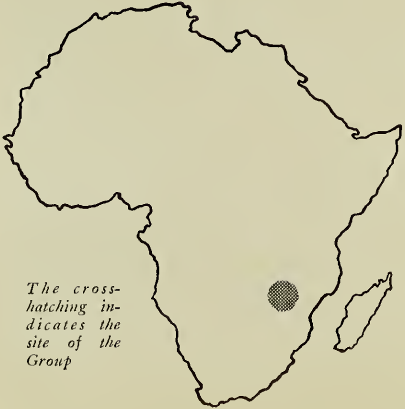
Gift of Mr. Daniel E. Pomeroy

Animals *by Robert H. Rockwell.*

Background *by Wm. R. Leigh.*

Flora and Foreground *by Albert E. Butler, assisted by George E. Petersen and Robert W. Kane.*

Birds *by Raymond B. Potter.*



The cross-hatching indicates the site of the Group

The greater koodoo (*Strepsiceros strepsiceros*), often spelled kudu, carries the longest horns of any of the African antelopes. In size and impressive character of horns, it is approached only by the sable antelope, the giant variety of which possesses great, sweeping horns but a few inches shorter. Greater koodoo are large animals and have a body size well proportioned to set off the great spiral horns to best advantage.

These antelope are to be found over a large part of Africa south of the limits of the Sahara. In some parts of South Africa, notably Cape Colony, it has been exterminated, but over other parts of its range it is still fairly common although local in its distribution. It frequents hilly or broken country which it seems to prefer to plains. It does not live in the heavy forests of the Congo, its favorite habitat being the brushy hillside, where it is adept at concealment and well protected by its neutral coloration. Good koodoo territory is usually very dry but with water accessible either at a river or water hole.

Greater koodoo are shy, wary animals, most active at night, early in the morning, and late in the afternoon. As the sun rises, they retreat into the shade of a thicket, where they spend the midday hours. When feeding, they wander out of the thorny jungle into the openings to graze, but when alarmed they take full advantage of all the cover available. They are said to be very acute of hearing. One hunter has suggested that the sound waves are conducted down the great spiral horns and into the ear.

This species may be seen in small bands or as solitary individuals. It does not group into larger herds as do some of the plains antelopes, and usually the females greatly outnumber the males. The old bulls with the finest heads are relatively scarce, and because more molested by the hunter, are more secretive and more difficult to observe.

It is not likely that the greater koodoo often falls a prey to enemies other than man. Its habitat preference keeps it out of regions where lions abound, but the leopard lives on some of the rocky slopes in the koodoo range, and against this cat the young koodoo and the hornless females must be on their guard. Not infrequently greater koodoo may be noted in areas where the natives run their herds of goats and sheep. If the number of these domestic animals is not so great as to take all the feed, the koodoo remain in the region, moving out of the way when a shepherd and his flock passes, but not disturbed or alarmed to the same extent as would be our North American big game under similar circumstances. In addition to grazing upon grasses, this antelope feeds upon the fallen fruits of certain trees and otherwise supplements the meager grazing possibilities of arid hillsides.

In the records of large game heads, the specimen of the greater koodoo listed at the top has horns 71½ inches in length, and, below this are seven heads each exceeding 60 inches in horn length.

The African Buffalo

GIFT OF MR. GEORGE EASTMAN

ANIMALS *by Robert H. Rockwell.*

BACKGROUND *by Wm. R. Leigh.*

FLORA AND FOREGROUND *by Albert E. Butler, assisted by George F. Mason and Joseph M. Guerry.*

BIRDS *by Raymond B. Potter.*

THE African buffalo (*Syncerus caffer*) is one of the group of wild oxen, all of the members of which are more or less closely related to the domestic ox. This particular variety of wild ox is one of those less intimately related to barnyard cattle in physical characters and the contrast is even greater when applied to behavior. The African buffalo bears the reputation, rightfully acquired, of being one of the most dangerous large game species for man to hunt. Fierce and intractable in disposition, possessed of great vitality, and clever in selecting the place and time for a charge, this animal has brought many a hunt to a tragic end.

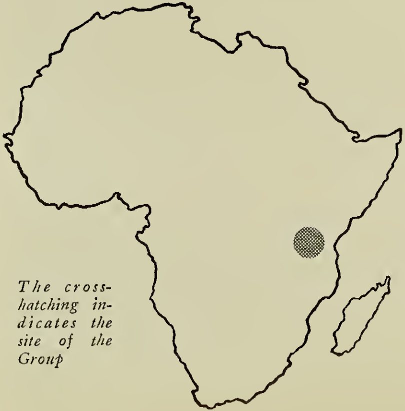
The African buffalo is widely distributed over Eastern Africa, from about southern Abyssinia to the Cape of Good Hope, where it is usually to be found near water. Environment to its liking may be found from the warm coastal plains up to elevations of 10,000 feet in the mountain ranges. In open, desert-like situations where water is scarce, buffalo do not occur.

The African buffalo is social in habit and the animals are found in herds the size of which varies from ten or a dozen to one hundred or more. The herd is composed of both sexes and apparently no one bull dominates the herd to the exclusion of all other bulls. The horns of the cows are not as massive as those of the bull and, while the former will charge an enemy upon slight provocation, the bull has the reputation of being more vindictive and less easily swerved from his purpose when pressing a charge home.

These buffalo feed mostly at night and lie up during the heat of the day, often in some marshy spot such as is portrayed in the group. Toward sundown they come out of cover to graze; after sunrise next morning they move back en masse from the feeding grounds into a thicket of brush or whatever vegetation the region affords. If the locality is one where water is to be found only at a river, buffalo will drink just before retiring for the day and may move back several miles before taking their rest.

The African buffalo is alert and must be stalked with care. All of its senses are keen, and the man who would observe this animal must guard against a quick eye, a sensitive nose, and a perceptive ear. The animal does not customarily charge unless it has been attacked, although there are records of unprovoked attacks upon people.

The African buffalo has suffered far more from the ravages of disease than from the attacks of man or other large animals. On several occasions outbreaks of epidemic violence have made heavy inroads upon the members of this species, one of the most serious of these taking place in East Africa late in the nineteenth century, when it has been estimated that not one in ten thousand was left alive. That the remnants were able to reëstablish the present large numbers is a striking illustration of the vigor of the species.



The cross-hatching indicates the site of the Group

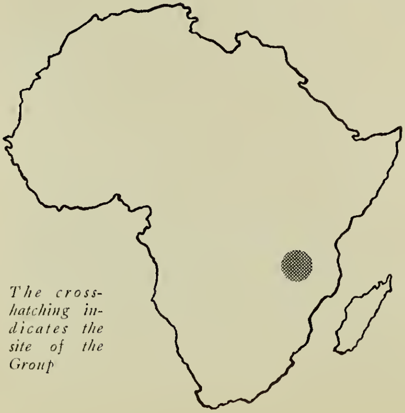
The African Lion

Gift of Mr. and Mrs. G. Lister Carlisle

Animals *by James L. Clark.*

Background *by Wm. R. Leigh.*

Flora and Foreground *by Albert E. Butler, assisted by Dudley M. Blakely, Joseph M. Guerry and George F. Mason.*



The cross-hatching indicates the site of the Group

The African lion (*Felis leo*) has been described under various subspecific names. These geographical races differ but slightly from one another and to the layman there is but one lion, the African lion. A lion occurs in Asia, a few are still extant in India, but in this instance also the variation in geographical range is correlated with but slight physical differences.

Formerly, a good photograph of an unrestrained lion was a prized trophy rewarding a patient and lucky stalk. Today there are well known districts where the photographer can drive in a motor truck and be certain of photographing not one but many lions. Along with the increase of splendid photographic records of the king of beasts has come an accumulation of life history data, in many cases with motion pictures to describe behavior.

The lion is to be found in practically every large-game field in Africa with the exception of a few regions where it has been exterminated. It does not go into heavy rain forest nor into the heart of desert areas where game is too scattered to prove a reliable source of food. Within recent historical times it has disappeared from the countries bordering the Mediterranean, and even later from the Cape Province.

In general, the lion does not molest man unless it is attacked by him, but individual animals, for one reason or another, may become man-eaters. The most famous of these were the lions known as the "man-eaters of Tsavo" and in this instance two animals took toll of the men working on a railroad project, killing many until they, in turn, were killed by Lieutenant Colonel Patterson.

The favorite food of lions is zebras, wildebeest, hartebeest, and other antelope of similar size and general habits. Lions sometimes lie near water holes to ambush animals as they come to drink, but often stalk close enough through tall grass or thick brush to permit of a final short rush. This rush of a stalking lion, or the charge of an angered one, is of great speed, but this speed cannot be sustained for any great distance.

In some parts of Africa where conditions are ideal for the lion, where there are great numbers of the species upon which the lions prey, and where the everyday association of lion and game herds has accustomed the herbivores to the necessary presence of the big carnivore, the animal world shows a surprising disregard of the lion. Lions may be in full sight of antelope which do not stampede as long as the cats are indifferent, and species like the reedbuck or bushbuck may use the same thicket in which lions lie up for the day.

Family groups of lions are frequently seen. Apparently, a lion and lioness may be mated for a long period, perhaps permanently, or one male may have several females which, with their cubs, will constitute a group of a dozen or more.

The lioness has from two to six cubs in a litter, but the usual number to be seen with a wild lioness is two or three.

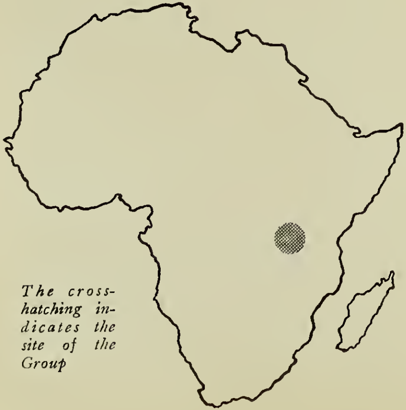
The Bongo

Gift of Mr. Daniel E. Pomeroy

Animals *by Robert H. Rockwell.*

Background *by F. L. Jaques.*

Flora and Foreground *by Albert E. Butler, assisted by Joseph M. Guerry.*



The cross-hatching indicates the site of the Group

The bongo (*Boocercus eurycerus*) is the deep-forest representative of the tragelaphine antelopes, the group of antelopes with spirally twisted horns typified by the bushbuck, koodoo, and eland. With its glorious brown to black pelage and well-proportioned body, it is probably the handsomest member of the group, although its horns lack the inspiring length of those of the koodoo and the massive character of the eland horns.

The bongo is never found out of heavy forest and its proper environment is deep, primeval stands of timber such as are associated with great rivers like the Congo or with humid mountain slopes. Roughly, its range extends from Liberia, the Gaboon, and Sierra Leone, through the forested land that follows the Congo drainage, east to Uganda, and along the Mau Escarpment to Mount Kenya. Throughout this area precipitation is favorable to luxuriant plant growth and in many sections the rainfall is very heavy. It is not uncommon for mammals of humid districts to show a marked tendency toward dark coloration. With the bongo, the dark pigment is a rich brown quite distinct from the color of other tragelaphine antelopes, but the common ancestry may still be detected in the presence of stripes and white throat-bands. Roosevelt and Heller consider it to be most intimately related to the eland. The coat of the bongo blends well with the dark forest environment and is of great value to an animal naturally wary and watchful. It is one of the truly difficult African mammals to stalk and observe.

Several races of this antelope have been described, the one shown in the group being the eastern race, *Boocercus eurycerus isaaci.*

The eastern race makes its home in forest where bamboo grows in extensive thickets. The undergrowth is thick and the cover so dense that not only is it most difficult for man to travel there, but also impossible for him to see into it for more than a few feet. In spite of the large size of the bongo, it is able to pass through this jungle at a surprising rate of speed and to move about, when skulking, without the noise which even the most skillful hunter must make under such circumstances. The keen senses of this antelope and its mastery of a difficult environment have kept it from falling to the rifle of very many white hunters.

While the bongo may rest, lying down to chew its cud, during the middle of the day, the natives say it does all its feeding during daylight hours. As there is no oppressive exposure to the direct rays of the sun in these humid forests, and the bongo is able to detect the coming of an enemy well in advance of its arrival, there is little need for night activity.

The bongo are apt to run in herds but these are not large; because of the thick cover, observations on the actual numbers are wanting, but it seems to be of common occurrence to find several animals together. Major Maydon, hunting bongo in Kenya, writes that he believes the big old bulls are very apt to travel by themselves.

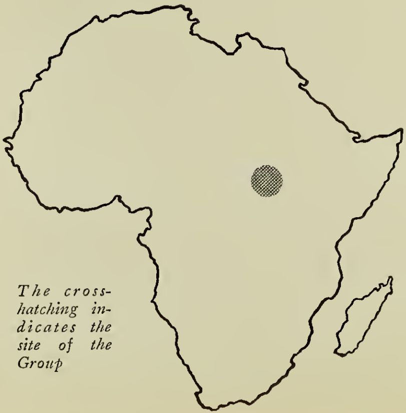
The Giant Eland

GIFT OF MR. C. OLIVER O'DONNELL

ANIMALS *by John W. Hope.*

BACKGROUND *by Wm. R. Leigh and Dudley M. Blakely.*

FLORA AND FOREGROUND *by Albert E. Butler, assisted by Dudley M. Blakely.*



The cross-hatching indicates the site of the Group

THE giant eland (*Taurotragus derbianus*) is the largest of all the antelopes. In body size it is as large as a domestic ox. While the giant eland is scarcely any larger than the common eland, with respect to body size, its horns are larger and more massive.

This species has a restricted range and is not found outside of a small area lying between the White Nile and Bahr-el-Ghazal and a similar circumscribed area in Senegal. Even in these regions the giant eland is not plentiful, and the total number alive today is relatively small. They run in small herds of from ten to thirty or forty, and because of their scarcity and local distribution, it is often very difficult to locate the animals.

The giant eland prefers dry plains of thorny scrub. It is a browser rather than a grazer and feeds upon the leaves of trees and shrubs. Often it breaks down branches to get at the foliage, and by using its horns, it can reach as high as seven or eight feet from the ground. The animals are great travelers, pulling off leaves while on the walk, and covering many miles in acquiring a meal.

Like many of the species of African mammals, the giant eland goes to water just before dawn and then, fortified against a dry, hot day, strikes back from the water into a dry back country. The terrain frequented by it is rather more arid than that preferred by most other antelope, and its ability to cover long distances between water holes makes this animal all the more elusive.

It will be observed that both sexes of giant eland carry horns, and although those of the cow may be as long as those of the bull, they are not as great in diameter and lack their massive character. The twist in the horns is characteristic of members of the subfamily of antelopes which includes bushbucks, koodoos, bongos, and elands.

The giant eland is wary, and the gray to tawny color of the pelage which blends into the background of thorn scrub through which it travels aids it in escaping observation. Not much other game is to be found in good giant eland country, and a hunting trip for this species must, perforce, be organized for the one animal alone, especially since shooting at the occasional roan antelope or hartebeest encountered would frighten the shy eland out of the country.

Its greatest enemy is man, since it is too wary and strong to be stalked successfully by lions. Unless the lion can approach by stealth (a difficult matter in the type of country where giant eland live), close enough to bring the first rush of the cat to the head of the eland, the latter is strong enough to shake off the lion. This antelope is not capable of any great burst of speed but, when frightened, breaks out of an ordinary walk into a fast trot. The maximum effort results in a gallop, but this is not sustained for any great distance.

Much of the territory inhabited by giant eland is also sleeping sickness country, a fact that has operated to keep hunters out.

(Above) Mr. and Mrs. Martin Johnson at camp in the gorilla country, which Akeley called "the most beautiful in the world"

Carl Akeley using the camera which he invented. It proved invaluable for work in the field

Camera Safaris

How the beauty of African wild life and landscape has been captured by the photographic lens and made its contribution to the Akeley African Hall

By Martin Johnson

All photographs by Martin Johnson

The enthralling creation of African Hall first concerned Osa and me in about 1922. We had just returned from our first African safari; our feature film "Trailing African Wild Animals" was completed and about ready for the market, but we wanted it gone over and given the stamp of approval before being released; this had to be done by an African expert, and of course this could be no one but Carl Akeley whose exploits in Africa were known by everyone interested in the so-called "Dark Continent."

Carl Akeley

Accordingly I made arrangements through a mutual friend to meet Mr. Akeley, and on reaching his offices in the American Museum, I found him at work on his lion spearing group. At this time he was just starting the clay models from which the bronzes were to be cast. His Nandi spearmen were composites from original models he made in Africa, photographs, drawings, and selected types of American negroes which he was using to make sure of perfect figures. I will never forget the pride I felt when he asked my opinion as to the forms of the many negroes he inspected. They must be figures as near the perfect type of Nandi as it was possible to get, and when he asked my opinion, I was forced to use great caution, for Osa and I had spent only two years in Africa, and very little time among the Nandi tribes. Most of our experience with savages up to this time had been with the natives we had encountered during the nearly ten years we had spent in the South Sea Islands and in Borneo.

The first few hours at the Museum I was in the presence of *Mr. Akeley*, but through that rare charm and feeling that he had, probably because of our mutual interest in wild things and of course in photography, it soon was "Carl," and never again did I think of him in any other way.

I now became an almost daily visitor at the Museum. Carl in turn visited our apartment and had many a dinner with us, always having a romp on the floor with "Bessie" our orang outang, and "Kalowatt" and "Wah" our two gibbon apes.

I knew that I never made a nuisance of myself and was never in Carl's way. He made me feel that. We had one of those understandings whereby we could be together for an hour without saying a word as he worked on his lion spearing models or on the mounting of his Gorilla Group. Or I would sit and watch him and listen to his stories of African adventure, of his plans for the future, and most interesting of all, his plans for the African Hall.

Early planning

I wish it were possible for me to state just when Carl's African Hall idea started, but I don't know. I know his ideas were well under way when I first met him. He had small models of the proposed building, the groups, the bronzes, and all the details that he visioned in the completed hall, but each day as we would talk he would make additions to his details, change or elaborate them.

It now seems to me that Carl was just then forming the actual model in his own mind. He was constantly getting new ideas that would change the ideas of the previous few days, but two of his thoughts stand out above all the rest, African Hall *must* be Africa, it must be true in every detail, and it *must* be done according to the new and modern methods of taxidermy. As he told me:

"Everything that has been done in the American Museum of Natural History in the way of African exhibits must be thrown out and completely discarded; we must start all over again."

As I look back to those weeks when I listened to Carl's plans, I marvel that everything has worked out just as he planned, even to the finest detail.

"I want to collect the groups myself," he told me. "I will take an assistant taxidermist along, and he will teach native skinners to work under us and do the work according to our ideas. Then I will have a couple of painters; they must be the best men in their line; one a landscape painter to get the scenery, the grass, the trees, the background, everything as perfect as it is possible for man to reproduce nature. Then another painter to do the animal studies and to work in the background, and an accessory man to collect the trees, the rocks, the pebbles, samples of the trees, bushes and grass."

Then he spoke of the photographic work necessary to supplement the measurements he would take of each animal before it was skinned. He wanted scores of pictures showing every contour, muscle and joint, every posture at rest and in motion.

"Tame" pictures most difficult

I doubt whether any one who has not tried it has any conception of the difficulties connected with making wild-animal pictures. The easiest thing to do is to shoot an animal with a high-power rifle at a comfortable and safe distance, or to run it down with a motor car, picturing the process and its excitements. The hardest thing is to picture that same animal in a calm, undisturbed state of nature. But we had worked out many of the problems on our first trip, and had thought out various new schemes we were eager to try.

Never have I spent a more interesting three months than during this time that I visited Carl almost daily. African Hall was the dream of his life. He was dreaming and planning ahead toward the time when he could get back to Africa and start his new work, and his dreaming caused me to dream. In fact, it was his thinking out loud that was responsible for the pictures and books that Osa and I have brought out of Africa since then.

Necessary backing

The photographic program which I worked out would require several years and a considerable outlay of money. The details of organization were complex. It was Daniel E. Pomeroy who came to our assistance. He had seen our film, "Trailing African Wild Animals," and was especially impressed with the photographic opportunities in Africa. He established a corporation, and provided $150,000 for our work.

Then we found ourselves on the way back to Africa where we were to remain for nearly four years while making "Simba." Osa and I built our grass home at Lake Paradise and a couple of years later Carl returned with R. H. Rockwell, his assistant, R. C. Raddatz, to collect the accessories and help in the taxidermy work, W. R. Leigh to do the background painting, Arthur Jansson to do the animal studies, and Mary Jobe Akeley, his wife, to attend to the business details.

Carl was in Nairobi several months before Osa and I were able to get down from Lake Paradise. We found Carl and his assistants working on their first group, not far from Nairobi. The rains were on and he did not care to get too far away until the country dried up, making traveling easier. Then again he wanted to be in Nairobi to meet George Eastman and Daniel E. Pomeroy, who were on their way out for a combined big game hunt and to help Carl in securing the groups.

Mr. Eastman, Mr. Pomeroy and Dr. Audeley Stewart arrived, and moved to the house the Akeley's were using at the edge of Nairobi. Osa and I were living at the old Norfolk Hotel, but most of the time were out at the house helping prepare for the first safari out of Nairobi. The rains were on—and I mean on, too! It seemed as though these rains were doing all they could to embarrass me, for I had impressed on all concerned that they should be in Nairobi by the middle of May in order that all arrangements could be made to go on safari by June 1, the official time for them to stop. But it rained and rained day after day. By the middle of June it was still raining and everyone was getting impatient, so it was decided that we would make a short safari into the Kedong Valley about forty miles from Nairobi, encamp there, and help Mr. Eastman secure a few trophies.

After a few weeks in the Kedong Valley we received word that the rains were stopping in the north country, so Carl and his safari pulled out first and made camp at a water hole on the Kaisoot Desert, a short distance north of the Guaso Nyiro River.

A real beginning

About ten days later the rest of us came along on the way to Lake Paradise. We stopped a night with Carl and here I saw the first actual work that was to result in making Carl's dreams come true. Mr. Leigh showed us the first paintings he had made, and I watched Carl and Rock and Raddatz at work on the first giraffe skin.

Leaving Carl and his staff at work at the water hole, the rest of us, including Philip Percival and Pat Ayers, safaried up to our home at Lake Paradise, then we returned by easy stages to Carl's camp again, stopping at various water holes for pictures and for a few trophies that both Mr. Eastman and Mr. Pomeroy wanted. Mr. Pomeroy secured a beautiful lesser koodoo, and Mr. Eastman secured a most interesting picture of a rhino charge. We saw a few elephants. I made the best leopard flashlight I had ever made, and Mr. Pomeroy shot his first lion.

It must be realized that a camera safari is a much more pretentious and exacting undertaking than a mere hunt where one is concerned only with food and ammunition. The photographic equipment alone runs to considerable weight and it must be carried in duplicate to guard against losses and accidents.

The problems encountered are many and complex. The camera makes certain demands. There must be fair light. The shadows must fall right, else the picture will be flat and uninteresting. The angles of view must be selected so as to avoid bald skies and awkward compositions. The footing must be stable and steady lest vibrations mar the picture. And that is only the beginning. The blind must be built to windward of the water hole so that the scent of the camera man does not reach the animals on some wafting breeze. If possible, the blind should be slightly higher than the spot to be pictured, because the scent, carried by the rising heat of the body tends to go upward. Also the blind must be as perfect a bit of camouflage as possible. The animals have a critical eye. They do not admire a conspicuous blind. It offends their taste in landscape and challenges their sense of discretion. They do not enjoy having their Africa tinkered with. They do not like the click of a camera either. They never consciously get confidential with a photographer. African animals have only two lines of action with reference to the camera. They either run from it or at it. Neither treatment is entirely satisfactory to the man behind the camera.

Many animals can be photographed from blinds, such as most antelopes and the other grazing animals like the giraffe and zebra. Also now and then one gets a chance at the lions and leopards and other beasts of prey which follow the herbivorous animals to the water holes. But there are animals in Africa which seldom or never drink—the gerenuk for instance. It is but by the merest chance that such animals stray within the range of a water hole blind. They must be stalked afoot by the camera man. It is always a stern chase, which is notoriously a long chase—with usually nothing more to reward the effort than a handsome rear view of a vanishing animal with his tail waving good-bye as he goes over the hill.

Choosing a water hole

Returning to Carl's camp we found that he had finished curing the skins for his water hole group, but Carl was not satisfied with the water hole setting in which the animals were to be mounted, so we spent a day, just Carl and I, walking to a water hole that I thought was typical of the water hole country of the Northern Frontier. Carl liked it and we made quite a few pictures of it from different angles. The only trouble was that the background in the distance was not good. It was necessary to have some hills or mountains in the distance to complete the sky line.

I knew just the water hole he was looking for; it was on the opposite side of the Guaso Nyiro River, almost opposite his present camp. I gave him the directions how to get there, and it was from this place that the finished water hole setting was made.

Osa and I found it necessary to hurry on into Nairobi, so we pushed on ahead, while Carl and Mrs. Akeley and the Pomeroy-Eastman safari went around Mt. Kenya to the north, stopping a few days at Embu Swamp where the Buffalo Group was secured.

Then all of us together in Nairobi started getting ready for the long safari south to the Serengetti Plains in Tanganyika. A few weeks later found us camped on the banks of the almost dry Seneraro River, and a little later we moved about a hundred miles to the Guremetti River.

Here on the Serengetti Plains we spent about three months and every day was a full day for all of us. We broke into separate parties in order the better to carry out our individual purposes. Mr. Eastman had by now secured the animals he was to contribute to the African Hall and was busy hunting trophies for his personal collection. Osa and Mr. Pomeroy were busy each day going after the Impalla Group. Carl and his party would usually spend a day securing animals needed for the groups, and the next day in skinning and curing, although I have seen Carl and Raddatz work almost all night through after a lucky day.

I would go after pictures each day and had wonderful success in getting the plains types of game, but no lions. Then one day Carl and Mrs. Akeley suggested that we make a picnic day of it and look over a valley where others in our safari had found a large number of lions. We found the lions—thirteen of them, in what we named Lion Valley. Day after day we photographed them, then we would lay off a day or two so that Carl could catch up with his other work, as Lion Valley furnished only pictures, and Carl must keep his own work moving along.

"Capturing" the color of Africa

One day Osa and I were returning from a long day on the plains; it was late afternoon as we were moving along the side of a hill; the lighting effects were beautiful as we looked away across the plains,—rocky outbreakings in the distance, the S-shaped dry river bed in the foreground, and game in countless numbers quietly grazing in big herds in every direction. In the middle distance were a couple of herds of giraffe, wild beasts all over the place, resembling drawings I have seen of buffalo on the American plains in the old days—zebra, topi, kongoni, Thompson's and Grant's gazelles; down under the trees by the river were waterbuck; a wild pig and some younger pigs trotted across the open space just below us, their tails in the air like flag poles without the flags,—a most interesting, beautiful and peaceful scene,—just Africa. Osa and I wished we could get a picture of it in color, but this was impossible. Then Osa motioned back of us, still higher up the hill and commanding a better view than even the one we had, and there we saw Mr. Leigh with his easels and equipment for painting; he was getting in color what we could never get with the cameras.

Drafted for a hunt

One morning very early (we were always up and eating breakfast before sun-up), I was preparing to go out for another day with my cameras, when Osa and Dan Pomeroy came up with the command that I accompany them on a hunting expedition for the day. Carl was sick in his tent; some of the groups were nearly finished, but a few animals were missing from various groups. Dan suggested that we try to get these animals, but I was reluctant to go. I was having the time of my life with my cameras; the plains were dotted with animals in big herds, a score of different species, lions were plentiful, and I wanted to make pictures while the sun shone, but Dan and Osa argued that I was working too hard and needed a rest; they could not realize that while I was working hard I was having more real thrilling enjoyment than anyone in camp. However, I was forced to accompany them. At first they were not going to allow me to take a camera along, but I flatly refused to leave camp without at least one camera, so they allowed me to fetch an Eyemo, the smallest of the cameras making regular 35mm professional film.

Now I had a grouch on. As I looked up at the cloudless sky, and then at all the game scattering as we moved across the plains, across little dongas and through small wooded spaces, it seemed that every group of animals was in a more beautiful photographic setting than ever before. It seemed they were tamer than on other days and easier to get close to. I became grouchier and grouchier as we moved along, and then to cap the situation we came upon a small herd of giraffe that moved slowly ahead, to be joined by a few zebra, wildebeest, gazelles, and kongoni. They moved slowly, kicking up their heels and stopping to watch us, then moving ahead as friskily as a bunch of young colts in a pasture. They were so intent on watching us that they did not notice where they were going, and then they suddenly found themselves cornered in a bunch of big rock outcroppings, in a little horseshoe space, with us covering the exit. The light was perfect, the most beautiful grouping of plains animals I had ever seen. I quickly got my Eyemo ready, started it going, made about three feet of film, then the blame thing jammed. Using language that I don't often use, I opened it up, found the film hopelessly tangled, ripped it out and loaded a fresh roll, and was within half a minute of being ready to make pictures when the animals stampeded and rushed past, and away off on the plains. I was the sickest photographer that ever lived, and even now when I look back over the scene that day, I feel sure it would have made the most beautiful wild animal scene ever taken by anyone.

Consolation

Well, you can imagine that this did not help my disposition. I was such a grouch that I am surprised that Dan did not become fed up and order me back to camp; but he probably knew just how I felt and tried to take my mind off the rotten luck I had just gone through, for he saw a lone wildebeest, a very fine bull, just the one wanted for the Plains Group. He turned to me and said "Get him, Martin; he is the exact wildebeest Carl has been wanting."

Now, I am a very poor shot. I don't care to shoot and consequently I don't keep in practice. I own some very fine and expensive guns, but my favorite is an old 405 Winchester that no one else takes seriously. I have had it for many years, and while, as I have said, I am not a good shot, I do hit things with it—just sheer luck. But usually when I do shoot, I do it when I am alone; then if I miss there is no one to laugh behind my back.

But I was in a bad humor and did not care what happened, so I took hasty aim, pulled the trigger, and down went the wildebeest dead as a stone. Gosh! I was surprised. But I helped place the animal in the motor car, and we started back to camp, as all animals for skinning must be treated as quickly as possible after being shot so that the hair does not slip.

Half a mile farther on, a very fine Grant's gazelle was found half asleep under a tree. Osa stalked to a position where she could get a good shot, pulled the trigger and missed, very unusual for her, as she really is a good shot. Well, feeling as cussed as I did, I raised my rifle and before Osa could get another shot, I pulled the trigger and down went the Grantie, shot clean through the heart, so clean in fact that he stood there for a few seconds exactly as though he had not been hit. My first thought was that I had missed, when he slumped down dead. And Dan and Osa slapped me on the back, telling me what a marvelous shot I was.

Another prize

But the big event of the day was to come. When nearing camp, I saw three pigs away off on the horizon, clearly outlined on the top of a small hill. I don't know how far away they were, but I do know they could not have been less than five hundred yards, and a pig is a pretty small object at that distance. A couple of wart hogs were needed for one of the groups. I had the car stopped, stepped out, and without taking careful aim, I fired. It was only a gesture for I was still sore at the world. Even at that distance we could see the pig tumble over. Going up, we found him stone dead.

That was a pretty good day, three animals with three cartridges. I was feeling all puffed up when I returned to camp, especially when Dan made the most of it in the telling, but I was mighty careful from then on that I did no more shooting before an audience. I had a reputation in camp and I meant to keep it.

A halt in work

By now Carl was a pretty sick man and it was decided that it would be best to send him into Nairobi, so one of my best and most comfortable trucks was bedded down for him, a place where Mary would be comfortable was made, and with John Wilchusen, our expert mechanic from the Willys-Knight factory, driving, he was taken into Nairobi to a nursing home, while the rest of us remained behind. Dan took it upon himself to get the remaining animals for the groups, then we all went into Nairobi. We found Carl much better, but still in the hospital.

We now scattered in different directions. Dan went down to Tanganyika where he secured the Greater Koodoo Group. He made another safari to the Kinna River country on the edge of the Kaisoot desert and finished the Lesser Koodoo Group. Mr. Eastman went up to Mount Kenya after elephant, but was not successful in getting a big one. He could have shot medium and small elephants, but he wanted a big fellow. Osa and I went back to Lake Paradise, and shortly afterward Carl left the hospital, and with Mary and Mr. Derscheid and Mr. Raddatz and Mr. Leigh went to Mt. Mikeno to secure the accessories and the paintings for the Gorilla Group, and to finish the plans for the Parc National Albert.

There is no need of my going into details as to what happened there, for I am sure that everyone interested in Africa and the American Museum of Natural History, knows of the tragic death of Carl Akeley, but one thing I would like to speak of.

An appropriate resting place

One day, before Carl took sick, he and I were talking of the gorilla country. By this time Osa and I had covered most of East Africa, and Carl was telling me of the photographic opportunities of the Congo. He told me of the adventures he had while with Mr. and Mrs. Herbert Bradley when they secured the Gorilla Group. He went into detail about the beautiful spot where he had been sitting when he saw his first gorilla, and in a dreamy way he said that when he died, he would like to be buried at that very spot. So it was a strange coincidence that he should be taken sick and that he died at almost the very spot he had told me about some months before, and was buried at this place, in the country he loved so well, among the gorillas that he had worked so hard to save from extermination.

Mr. Eastman returned to America, Dan Pomeroy returned a few months later, while Osa and I remained on a few months to complete "Simba." Then we, too, returned to New York. We saw the African Hall start to materialize, but our hearts were in Africa. Osa and I did not remain long in America. Soon we were back in Africa, this time with Mr. Eastman on the Nile and in the Congo and in Uganda, where he secured his white rhino and his elephant.

The elephant presents a special set of problems to the camera hunter. He sleeps through the day and eats in the cool of the evening and night. We have spent weary weeks following various small herds before we could catch them under light conditions that would permit the making of satisfactory pictures. And there is always the possibility that if you get too close you will spend more time getting out of their way than you will taking pictures.

Then we returned to America again, and the African Hall was moving along slowly. Again we returned to Africa, this time to film "Congorilla" and to visit Carl's grave on Mikeno.

With us was DeWitt Sage, who climbed Mikeno with us. We heard from the pygmies that the gorillas were now on the opposite side of the mountain from where Carl was buried, so it was some weeks before we finished our work with this group of gorillas and safaried over the mountains to Carl's grave, up and down hills and valleys at an altitude around 12,000 feet all the time. Almost exhausted we arrived in the saddle of Mikeno late in the afternoon, with a cold, drizzling rain sweeping through the valley. Osa, DeWitt and I went directly to Carl's grave before making any preparations for camp. Briefly we paid our respects to the sleeping Carl, one of the best friends we ever had. His grave was in remarkably good condition, covered with a cement slab, his name and date of his death engraved over the head, surrounded by a high log stockade to preserve it from the buffalo in the vicinity.

An unhappy beginning

Here we built camp alongside the grave, and spent a miserable night. The ground was soaked with rain, cold fog drifted into the tent; we could not sleep warm because our bedding was wet, and we did not have enough blankets; but outside our porters were in worse shape than we were, they had no tents. They just rolled up in their soaking blankets and went to sleep. I expected to have a lot of sick natives on my hands next day, but they were used to such hardships and not one even showed a sign of cold when we arose next morning with the sun shining clear and bright.

Then we examined the grave again and found that Raddatz had done an excellent job when making it. The large slab covering it was in perfect form without a single crack, and the inscription was as clear and legible as the day it was placed there. It was evident that Mary had selected the best location to be found, as the drainage was perfect.

During the following days Osa made minor repairs to the stockade and planted evergreen flowers around the slab, while DeWitt and I explored the surrounding country.

Patience rewarded

The first place I now wanted to visit was the spot that Carl had told me about, the spot where he had first seen gorillas, and the place he had described as the most beautiful view he had ever seen. Magollo, Carl's old guide, knew the exact spot and took us there. It was only a stone's throw from his grave. When DeWitt and I reached the spot, it seemed anything but beautiful. The cold, damp fog rolled over the country so that we could see nothing a few feet away, but we decided to linger in the hope that the weather would clear. We built a fire, and determined to wait for a rift in the clouds. Intermittently the sky would reveal itself for a minute or two, then disappear. Patience is a virtue, they say, and in this instance we were bountifully rewarded for our three hours' vigil. Clouds and fog were peeled off the mountain-side. The sun broke through, glorious and clear. We could see for fifty miles or more. Active volcanoes sent thin streamers of smoke into the air. Beyond were rolling mountain ranges. We could see Lake Kivu in the distance, and alongside it a range of mountains to the west which our guides reported were the habitat of gorillas. The scene unrolled before our enraptured gaze was a magnificent panorama, noble, majestic, and overpowering in its effect—a fitting canopy for the final resting place of Carl Akeley, who was its discoverer for the world of white men.

Now that I think it over, I agree with Carl as to the wild beauty of this place, and I will always think that Mr. Leigh's striking paintings that form the background for the Gorilla Group, have captured Africa as it has never been done before.

As I write this, Osa and I are aboard a steamer in the Red Sea on our way to Borneo. Three weeks ago we spent several hours going through the nearly completed African Hall, and we marveled at the wonder of it all. To us it is the finest thing ever done of its kind. We stood in front of the Gorilla Group and again saw that wonderful view from Mikeno. We forgot the hardships and the mist and rain and cold. We saw only that marvelous view with the Gorilla Group mounted into the scene, so real and so colorful. That group is a masterpiece.

Then we moved to the Water Hole Group near Archer's Post on the Northern Guaso Nyiro River. We have camped in at least half a dozen places in the distance in that very scene. It is perfect in its makeup—the water hole itself, the mountains in the distance, the Dom palms scattered between the river and the water hole. Some, who do not know Africa, will think the colorings are exaggerated, but we know they are not. We have visited this place at least a dozen times during the past sixteen years and know the scene as reproduced in the American Museum is perfect in every detail.

The Plains Group

Then we moved to the Serengetti Plains Group. Here again is perfection. Thousands of animals to be seen in the distance are just as you would see them if you went to that spot right now. And we recalled the day we had stopped and looked over the plains and then back to Mr. Leigh as he was painting back of us. We pointed out to each other the places where we had camped during the past sixteen years. Every detail was perfection, and there in the group was the big wildebeest I had shot while with Osa and Dan; and the Grant's gazelle.

Then we were in front of the Impalla Group that Osa and Dan had worked on so hard in order to get the animals of just the right size. I was not along when they secured this group, but every mounted animal meant an adventure to Osa.

And there was Dan's Greater Koodoo Group. Neither Osa nor I were along when he secured the Koodoo, but Dan had told us of his trials and hardships in getting these beautiful animals. We met in Nairobi at dinner the night Dan returned from Tanganyika, and heard his thrilling story of getting them in that hot, rocky, semi-desert down near Dudoma.

We were not along when Mr. Eastman secured the Buffalo Group at Embu, but we know that buffalo swamp well, and know it is true to life—the cow herons on the backs of the buffalo and scattered about in the swamp, snowclad Mt. Kenya in the background, the hills in the middle distance, all just as they should be and all marvelous in their perfection.

The bongo and the giant forest hog among the dense bamboo forests—why, we could almost feel that we were there again, especially Osa who has spent much time up there hunting bongo and fishing for trout in the clear mountain streams.

Realization

It's a wonderful hall, that African Hall. Surely if Carl could see it today he would not be able to find a flaw, and how proud he would be that his dream had come true, and that the people of America could see Africa exactly as it is—Africa that will some day disappear as civilization marches in.

Osa and I feel proud that we have had a small part in making Carl's dream come true. The elephant herd in the center of the Hall was not completed when we left America, but we can visualize it from the drawings and small models. Mr. and Mrs. Davison spent months in getting the four elephants to add to the four that Carl secured and mounted before he died. We were with the Davisons when they shot the elephants on the Tana River in East Africa—every elephant an adventure. What a thrill for them when they see their herd combined with Carl's!

The men behind the Akeley Hall

It was the late Henry Fairfield Osborn, for twenty-five years president of the American Museum, who saw Carl's dream start and helped work it out. It was the energy and enthusiasm of Dan Pomeroy who pushed the Hall through from beginning to end; President F. Trubee Davison whose interest kept the idea going; James L. Clark and his staff of taxidermists who have supplied the last word in mounting; the staff of painters who have reproduced the African scenery so truthfully.

(Right) Carl Akeley surveying the water hole which was chosen as ideal for reproduction in the American Museum group

(Below) The personnel of the Eastman-Pomeroy-Akeley African Expedition

(Above) Mr. Akeley changing a film pack in the field

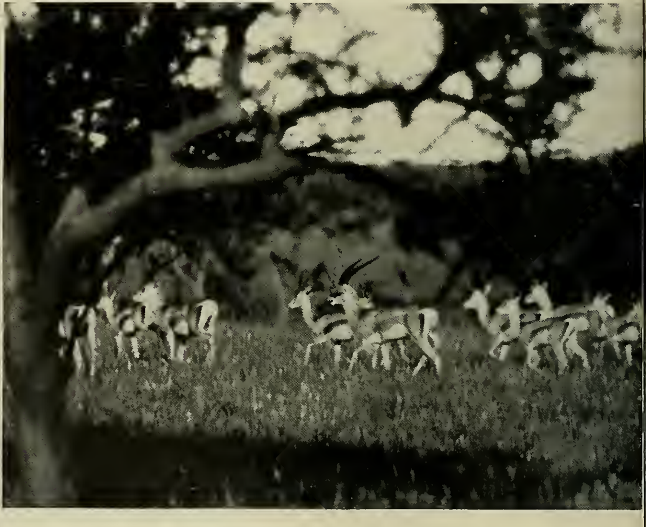
(Left) Mr. Eastman with a native porter in Tanganyika

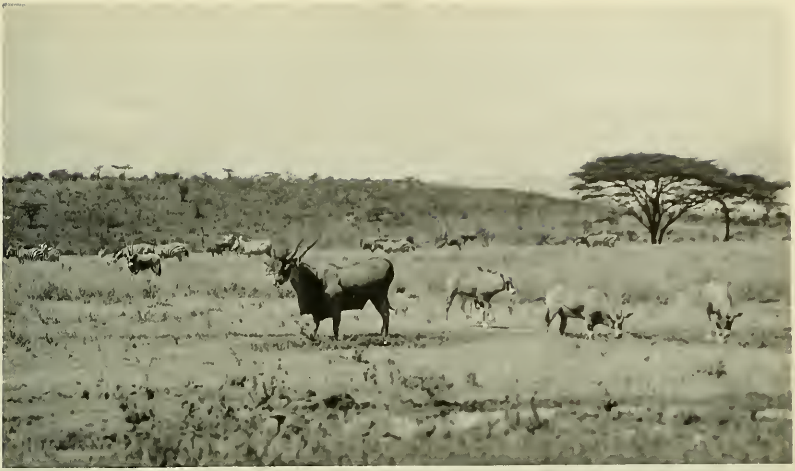
(Opposite page) Upper picture—Mr. and Mrs. Akeley with a group of Lumbwa natives

Lower picture—Messrs. Leigh and Jansson, artists, showing the sketch for a group background to Messrs. Pomeroy and Eastman

The giraffe—a creature that makes a fantastic picture on the African landscape. These were photographed on the Serengetti Plains, where game in countless numbers quietly grazed

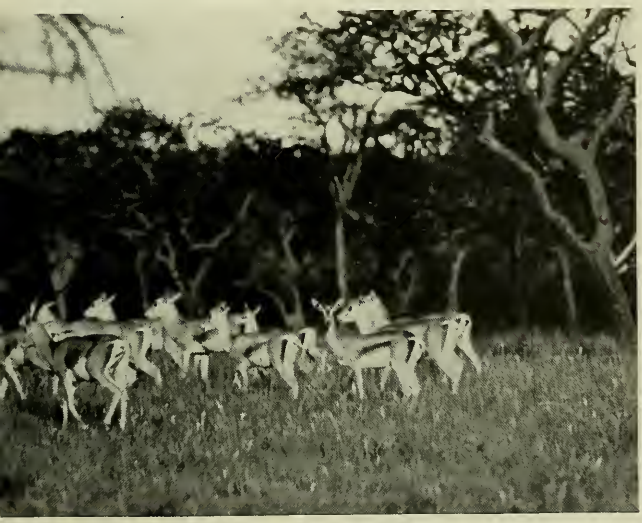
The most difficult type of picture to obtain is one showing wild animals in an undisturbed and natural state. The photographer has not only to consider the usual problems of light, shadows, and composition,





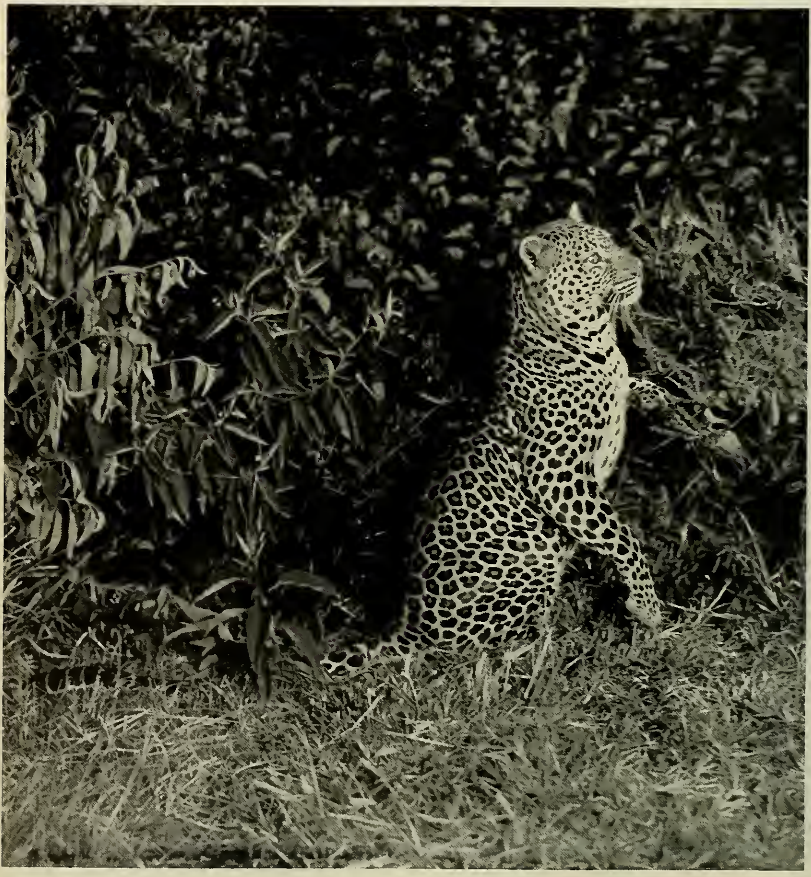
A water hole is an ideal spot for a photographer of wild life to catch his game. A giant eland may be seen above in the center foreground, with several oryx and zebra near by

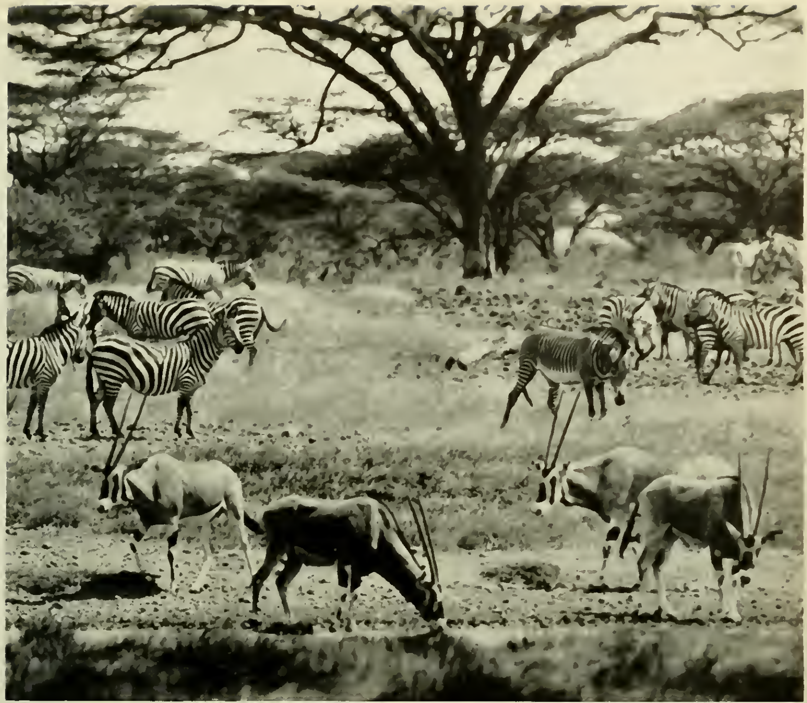
but has to work without letting the alert creatures know of his presence by sight, sound, or smell. The picture below of a herd of Grant's gazelle is well worth such effort



(Right) Camp of the Eastman-Pomeroy-Akeley African Expedition combined with the Johnson party at Tanganyika

(Below) A leopard which made a flash-light picture of itself (in coöperation with Mr. Johnson) at Lake Paradise

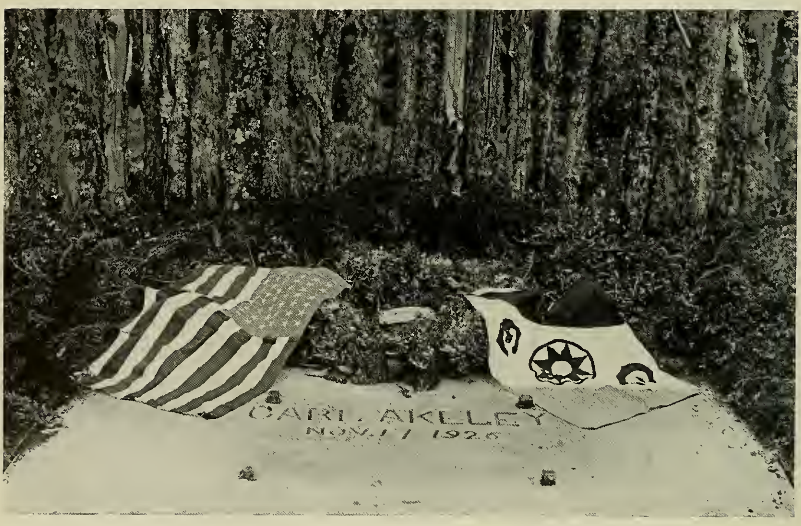


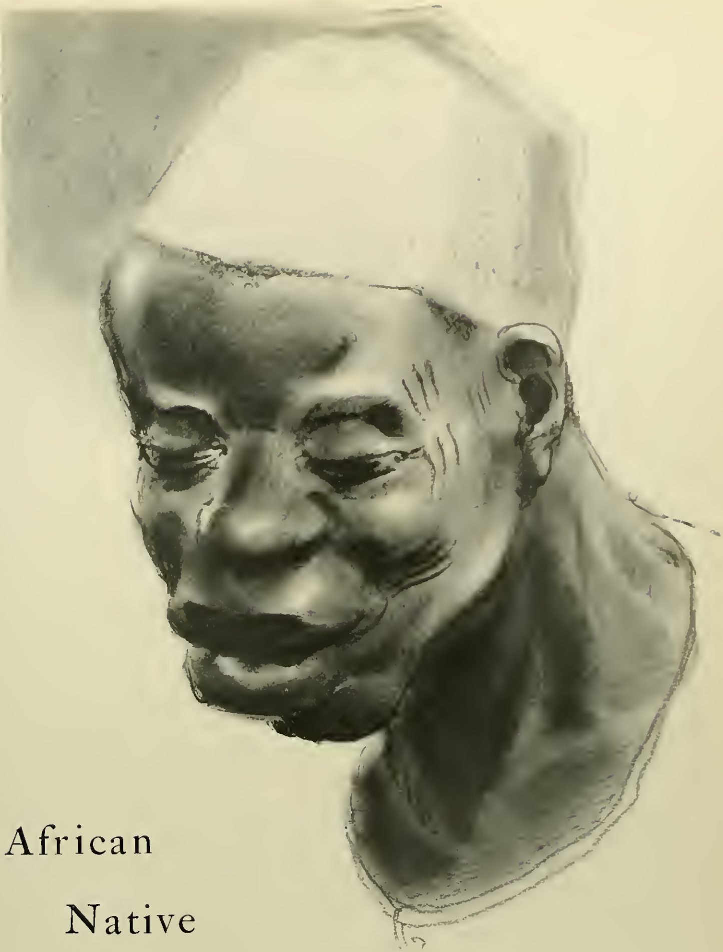


(Above) A typical assemblage in the search for water—oryx and zebra at Chobe water hole

(Right) A group of wild dogs apparently entirely unaware of their proximity to a camera

Carl Akeley's final resting place on the slopes of Mt. Mikeno, in the gorilla country he loved so well. (Above) Mr. and Mrs. Johnson at the end of their pilgrimage to pay tribute to the memory of their departed friend

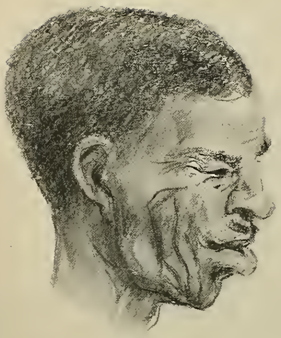




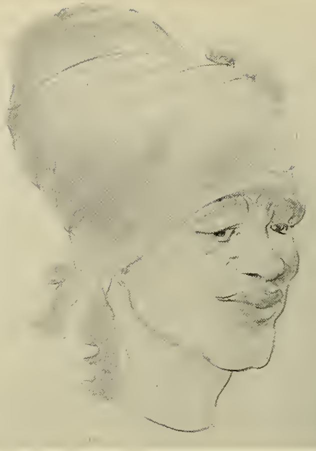
African Native Types

A series of drawings by Carl N. Werntz, President, Chicago Academy of Fine Arts

A Hausa merchant, from Lagos, Negeria. He offers for sale intricately stitched leather novelties, all the while blissfully unconscious of the similarity of their design to the pattern on his own tattooed skin

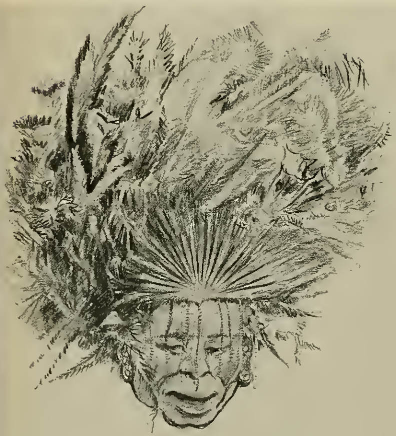


(Above) The artist sketched this individual because his facial angle was so like that of the wax Bushmen in the Cape Town Museum

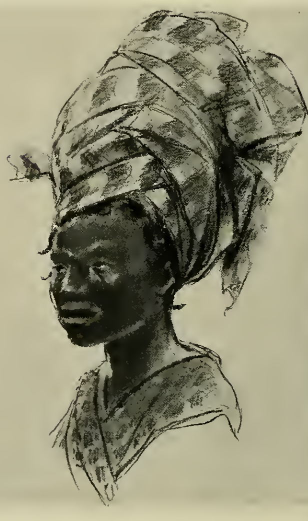


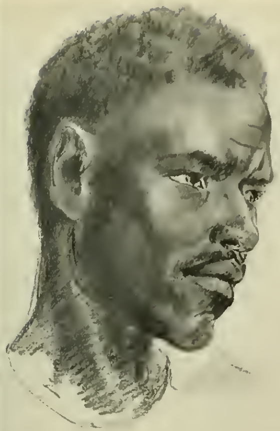
(Above) "Nona"—escaping some of her race's cranial distortion—is a true Hottentot woman, rather pretty in bright print dresses fashioned after an ancestral "Missie's" wardrobe

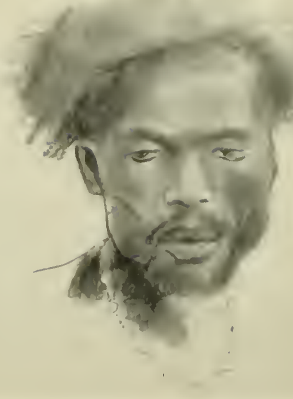
(Below) This old Wamanyama woman dancer of Mombasa has crowded every possible decoration into her headgear and painted her face white to celebrate the end of Ramadan



(Below) The Abakota market woman of Lagos wears a typical headdress without which she would be suffer loss of trade





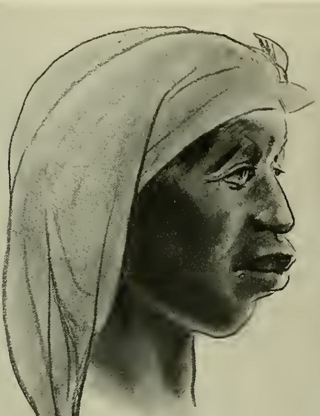


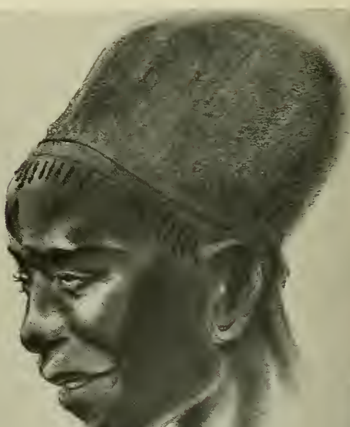
(Above) "Mwemba" a member of the Mtoka Tribe, Northern Rhodesia. He was adopted in infancy and raised to manhood by Hottentots. He is now an intelligent garage worker

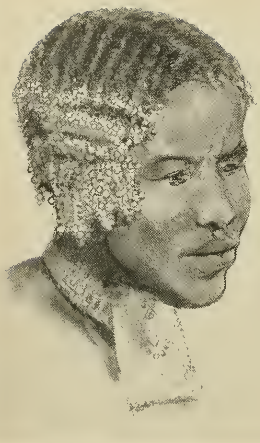
(Below) A Chimondo girl from Hana del Norte, many miles inland from Portuguese West Africa's coast. She works at collecting coconuts for a Garden of Eden oil mill

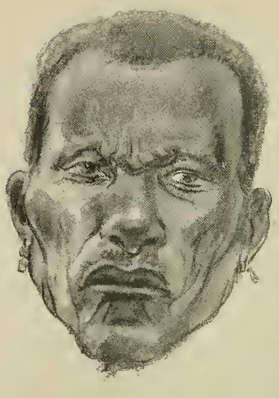
(Above) Pholongwane Magugula is a warrior in the krall of the Paramount Chief, Swaziland. Occasionally he writes poetic war chants

(Below) Ntitobhi—a Swazi "princess," sister of the Paramount Chief. She was the only member of that "royal" family who was willing to sit for a portrait







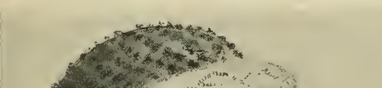


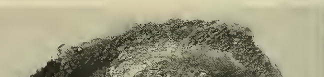
(Above) Eshowe, a Zulu girl, decorated with beads strung on her own hair grown long for the purpose. The beads are European, the craft African. Eshowe writes her love letters also in beadwork

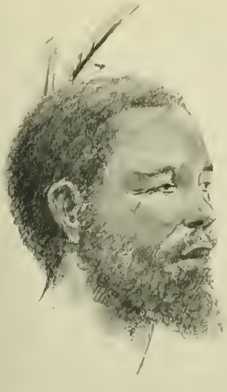
(Above) Jafuta, Matabele Induna. Intelligent, soft voiced, and deeply concerned for the depleted food supply of his people, he was found miles out in the trackless bush south of Victoria Falls

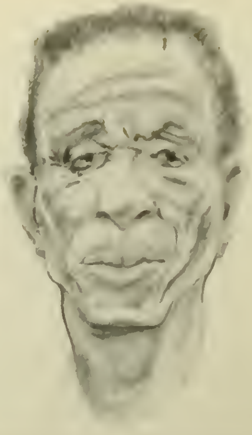
(Below) Ready for a celebration is this Zulu headman, whose ceremonial feather headdress and waxed moustache proclaim him a dandy

(Below) Sobhusa, Paramount Chief (hereditary "king") was reluctant to pose because he was not dressed in official silk hat and frock coat







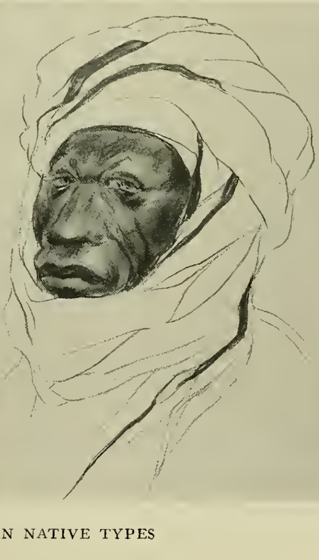


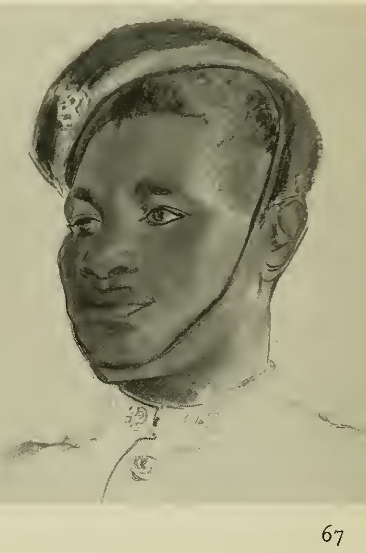
(Above) Induna Dhlamini. The official position of this Swazi Paramount Chief adviser is indicated by the feathers in his hair which were selected for the purpose with the most painstaking care

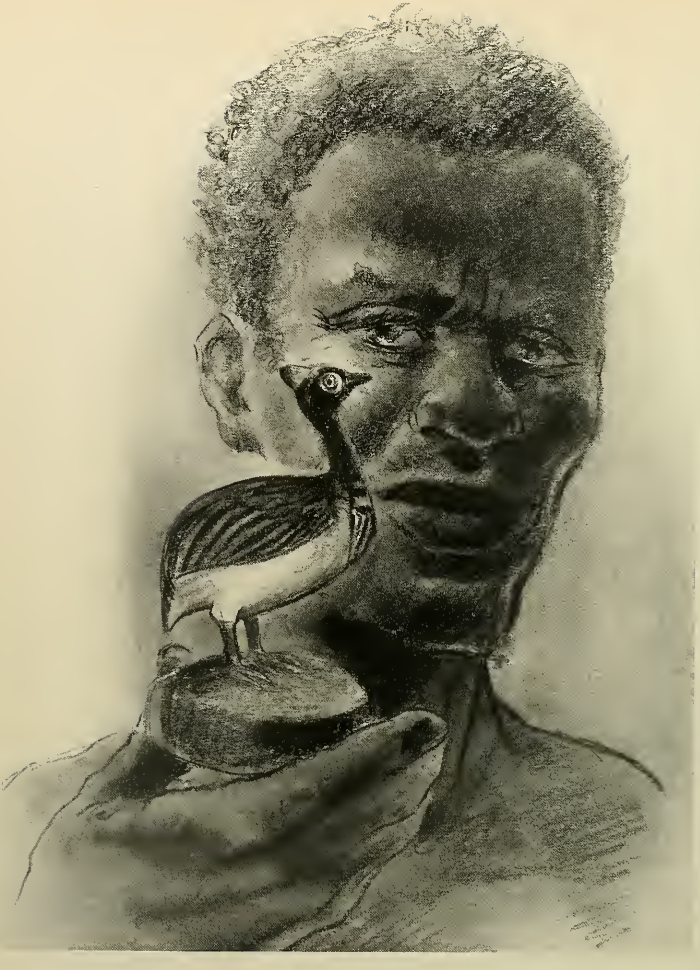
(Below) A Fula merchant of Accra, British Gold Coast, bears a close resemblance to his Moroccan brothers across the Atlas

(Above) This Hottentot sketched in Walvis Bay—a town not quite registering as either land or water—readily admitting his race, claimed the name of "Joseph," but when pressed, acknowledged he really was "Gachab"

(Below) Proud of his office is Police Sergeant "Mciniseli," a trim government employee in Manzini, Bremersdorf, Swaziland







A NATIVE ARTIST

This Kubindo sculptor in Luanda, Portuguese West Africa, like any artist, loved his creations. Though glad to sell for civilization's modern exchange, his natural recompense came by finding others who liked his birds of carved wood

The Image of Africa

Africa and its beauty—mysterious jungles, rolling plains, strange trees and flowers, roaming animals—invite the visitor to the American Museum to explore at his leisure

By JAMES LIPPITT CLARK
Director of Arts, Preparation and Installation, American Museum

BEHIND the scenes of a great institution like ours there lies another little world, quite different from what our visitors suspect when passing through our quiet, spacious halls, viewing scenes from other lands so real they quite forget they're in a museum.

Back of these closed doors our little world just buzzes with its infinite interest and manifold activities of management, research, and exhibition.

Little, too, does our visitor suspect that from our Museum building pour forth each evening more than five hundred men and women who serve our institution in one way or another throughout the year.

Highly specialized units

Around each activity are grouped individuals especially selected to serve that particular branch in some way or other. Not least of these multiples of highly specialized units is the department of arts, preparation and installation, a group of artists, craftsmen, technicians and assistants, who, in coördination, create, besides many other things, those colorful exhibits of animals in nature, those scenes which are truly works of art, like great paintings in three dimensions.

Such exhibits fill African Hall. Akeley did much, through his development of technique, to make possible such exquisite pieces of work. Without his tireless hours of work and research, he never would have developed the sculpturing method of setting up animals, instead of "stuffing" them; nor would he have developed that ingenious and highly technical method which makes it possible for us now to undertake a whole herd of elephants as the centerpiece for African Hall. Elephants before were a bugaboo to taxidermists and museum directors alike, for they implied such seemingly insurmountable difficulties that they were only very occasionally attempted by some courageous soul or some ambitious one who, ignorant of the difficulties, went headlong to disaster. And that is why so few are now to be seen on exhibition.

Progressive ideas

These improved methods, with the artistic ability of the various members of the preparation staff, have alone made possible those wonderfully lifelike animals now to be seen in African Hall, while other progressive ideas, in the construction of groups and group cases and details attendant upon them, all laid the foundation for the very successful culmination of this beautiful hall.

My association with Akeley began in 1902, when, coming to this Museum purely as an animal sculptor, I became acquainted with him while he was still associated with the Field Museum. He became interested in my work, and after a time divulged to me all the secrets of his new methods. He told me he looked to me to "carry on," and from then until his death we worked side by side, in Africa, in the Museum, in the development of his camera, and in the planning of this great hall.

He died when on the threshold of the realization of his greatest dream, and it fell to his associates to carry on. To me came the part of organizing the staff for creating the groups themselves and guiding the artistic phases of these and the hall. Akeley had constructed a small architect's model of his proposed hall. This, on a scale of one inch to one foot, showed the main and mezzanine floors, with spaces for sixteen groups to a floor and his four elephants in the center.

In this, one or two little sketch models of groups suggested what might be the treatment of the others. Obviously, as there were so many kinds of animals in Africa, the difficulty was not what to put in, but what to leave out. Opportunities, too, would often govern the selection and securing of a group, so Akeley went to Africa on his first trip with an open mind.

As a result of this first African Hall Expedition—the Eastman-Pomeroy-Akeley African Expedition—several groups were collected, and upon my return from the Morden-Clark Asiatic Expedition, I was asked to take full charge of this work and organize a staff to cope with the very pretentious program ahead of us.

No such thing had ever been attempted before, either in quality or scope, and there were no precedents to guide us. Ways and means had to be found for the first time, problems had to be overcome as they arose, and methods invented to meet new demands.

A staff organized

First of all was the building up of a staff, which eventually totalled some forty-five, all directly or indirectly on African Hall. With outstanding co-workers like Mr. Albert E. Butler, my associate chief, Mr. W. R. Leigh, as master background-artist, assisted by Dudley Blakely, Messrs. R. H. Rockwell and John W. Hope as the leading animal sculptors, and Messrs. U. Narahara, G. E. Petersen, G. F. Mason, J. P. Guerry on the flora and foregrounds, and a score of other hand-picked artists and craftsmen, we began to move forward in the building of these exhibits.

Now that we had started, questions and problems not previously anticipated began to arise, while, for the time, at least, no answers could be found. Things were dependent upon one another, and the only way to solve them was to build a larger miniature model of the hall, wherein we could work out these problems and at the same time develop the ensemble of groups and hall.

This we did, scaling it two inches to one foot, which was large enough to develop our plans. From architects' blue prints of the building itself we built this model, setting structural columns and other fixed features in their proper places and then developing the interior treatment of case fronts and group spaces.

The group in miniature

When the structural and architectural problems were solved, we concentrated on the groups themselves, the animals to be shown, the type of country and its flora. From a mental picture based on our personal experience and data at hand, we began constructing our little groups, also in miniature. Little animals were modeled and painted, little trees and little rocks made, and then all assembled in our little group, behind which the artist painted a scene of the African veldt or jungle forests. All was arranged to tell the story of how and where these animals lived, and changes were made to perfect the composition, both in form and color. It was like a little doll's house—placing each little piece of furniture so as to develop the best decorative treatment of that little room.

Several groups were carried on at one time, purposely, so that we might, while making them, get them as varied as possible and show not only different animals, but totally different types of country and totally different plant life.

These were made in contrasting color tones, moods of nature, to give further variety. It was give and take here and there, until our little groups were well balanced by contrast and accepted as final. These then became our working models, our "blue prints," to guide us. Problems of construction, lighting, balance, technical difficulties, and many other lesser pitfalls were all solved in this miniature hall, and all of our uncertainties and experimenting were finally behind us.

We could now go forward. The background artist knew just what he was to paint; the animal sculptor knew just how to pose each animal; and the creators of the flora and foreground knew just what plants were to be made, how large they were to be, and where each was to go, so that it could be built to exactly fit the spot.

True, minor changes would be made as we

progressed, but only if they suggested themselves as improvements, but for the most part everything was closely adhered to. Otherwise, the careful planning in our little model would go for naught, and our group might flounder in hopeless confusion, far beyond ever bringing it back into a coördinated unit of artistic composition.

Opportunities in the field

None of this could have been accomplished so successfully of course, had not most of those working on it been to the field and seen Africa. There is no way of imparting to a creator of an artistic unit those subtleties which give that finesse that differentiates the ordinary from the exquisite. Such things must be felt, must be absorbed and assimilated, and then in turn, with understanding and enthusiasm, given out by the creator.

In so much as he has had the opportunity to see the beautiful and the power of feeling it, just so much will he give out in the expression of his work. Whatever success African Hall may enjoy, therefore, is due to the careful selection of our personnel and the opportunities they have had in going to the field.

The successful creation of a group or a hall does not begin behind the closed doors of the laboratory or office, but has its conception from a knowledge of the field condition. Akeley would never have dreamed his hall, had he not been to Africa several times and had its beauty and wonders indelibly impressed upon his mind.

So with the unit of a group—its first conception must come from experience in the field, from someone's knowledge, based upon what he has seen. Animals, plants, and material cannot be taken without a plan, an idea, of what the unit is going to be. Therefore, our groups are very often conceived in the very lair of the animals.

And with the animals—a successful group begins with the careful selection of the individual animals through the field glasses, even before they are shot. Then follows the painstaking and intelligent preserving of the valuable skins, that they may arrive at their destination without damage.

This is also true of the plant life, first selected for the part it plays in the animal's life or what its presence may indicate to the botanists or the geologists. Each unit selected should have some significance in relation to all others in the group.

In this way our groups gain in educational value. Even in the case of the background, it is not just a scene. It is a painting of a very definite spot in Africa, selected because it not only is the place where the animals were taken, but because it typifies the characteristic country in which they are to be found.

And so it goes—ever back to that intimate study of nature, before we dare make a selection, or even a decision. Much of the creative side is over when the material reaches the Museum. From then on, the technical side is foremost, wherein much labor and patience are involved.

True, not all the creative work is done, for now we must recreate what we have torn down in the field in order to bring it back. Now we have but the flat, dirty, and ugly-looking skin of the animal and a greasy lot of bones. We have none of the style, posture, or rounded conformation of his beautiful body. We have none of those veins and tendons and ripples of the muscles or the flash of the eye or pitch of the head. All looks hopeless.

"How can you ever make anything out of that mess?" says our visitor.

Those old dry bushes with dead leaves; and old tin cans full of dirt; bundles of stuff that looks like hay; pieces of old rock; some logs and an old tree stump—they all look headed for the ash heap.

Re-creation

Well, that is exactly what the department of arts, preparation and installation does—recreates those lovely groups from a "mess" like that. That is the material side. The art comes from elsewhere, from what we have seen, from what we have absorbed, from what we have felt.

Now the animal sculptor begins his clay model of the animal. From measurements, photographs and studies, he places the skull and leg bones of the animal on a frame and piles on clay until he has an anatomical study of the animal without the skin, the clay going over the bones where the muscles came off. While he carefully sculptures the contours, the tannery is at work preparing the valuable skin, which, in a relaxed condition, is frequently thrown over the model to check the fit and posture of the animal.

When all is satisfactory, a plaster mold is made of this clay model, and in this mold is constructed a thin, light shell of maché and wire screen or burlap. This shell, reinforced with wooden ribs and iron rods in the legs, is removed from the mold and assembled, and now carries its own weight.

The skin, now completely tanned into soft leather, is relaxed in a poison-water to prevent attacks by insects, and in this flexible condition is applied to the modeled form with an adhesive. It is arranged as one would fit a wet glove on the hand, adjusted here and there, until each part is properly placed over its final position. The seams are sewn together and then it is allowed to dry.

Carefully made glass eyes of proper color are inserted and the lids modeled softly over them, while the cartilages of the ears are entirely replaced with sheet-lead replicas.

When thoroughly dry, a good brushing and arranging of the hair, painting of the eyes, lips and nostrils, add the finishing touches which give that final effect of life. Hardly can one believe, turning to other old bones and skins still untouched, that such a lovely creature could be made of them.

As for the old logs and sticks and bundles of bark, these become trees, and upon them go green leaves, shapely and fresh, as if in nature, so lifelike that our visitor hardly suspects they are made of beeswax and cotton, sheet celluloid, or just colored crepe paper. Bushes, too, come to life, with a burst of gorgeous flowers, which only Solomon's bees could detect, "re-created" from that jarful of colorless and wilted, but preserved, bunches of seemingly nondescript vegetable matter.

Growth of the units

All is definite material—supplemented, of course, by pencil sketches and color notes, to supply those elements which have been fugitive. Tins of soil serve as samples for the ground, while bits of rock give the color and texture of the big ones too heavy to bring back home and which we have decided to recreate also. From our photographs we faithfully reconstruct replicas in wire screening which we cover with burlap and plaster and stipple with a sponge or brush, to give it the desired texture. From our sample, an artist carefully colors it so true that we ourselves cannot be sure which is which, unless we pick it up and feel the weight.

Clumps of old dead grasses, mosses and lichens are rejuvenated in a bath of hot water, which swells them back to normalcy. Another bath in glycerine, water, and arsenic holds them against further shrinkage and possible attacks of hidden insects, while they are air-brushed with colors of selected hues.

True to the model

Unit by unit grows throughout the various corners of the studios, while in the hall itself, after group cases have been constructed of iron and plaster and have been surfaced with canvas, the artist paints the background.

Now he must follow our little model closely and not deviate, lest he disturb important features of our composition. All units have been so dovetailed in their careful placing that to disturb one now would involve changing all, and we have gone too far for any reconsideration.

Lights are installed, adjusted from above to enhance desired color tones or to cast sunlight and shade over animals or parts of our group. Units, like rocks or bushes or even an animal, are put in from time to time to establish the proper relations of color between foreground and background.

With all units complete—painting, animals, plants, trees, rocks, etc., which may take a period of from one to three years after all this material has been taken in the field—we finally give the group a "dress rehearsal," and assemble them all within the case.

It is only now that we may break faith with our little model and turn wholly to our group, for now we have it all together and can see in the big life-size unit how well our little model has worked out.

Factors sometimes change when enlarged to life-size form, and only now can we best judge whether a change here or there will improve the whole, or not. Seldom do we make any radical change, hardly more than moving something slightly, or transposing two lesser objects.

With the final arrangement approved, the groundwork is laid in and constructed around the major units now in place.

For this we use a framework of wood, covered with wire screen, burlap and plaster, much like the rocks, and give it texture and a surfacing with the natural sand or soil, as the case may be, while the colored clumps of grasses and smaller bushes are incorporated in the ground as we proceed. Débris from the ground, broken sticks, dead leaves and blown grasses, a land-snail shell, a piece of an old horn from some departed denizen, are strewn about in careless manner, as the last finishing touches to our group.

A final once-over, arranging the direction of some blades of grass, slightly adjusting a light that it may put a sparkle in the eye of an animal, a shadow here or there—and the plate glass goes in place, not vertically, but on a slant, so that one standing in front of it may not see reflections.

One by one our groups grow into being and take their chosen place in large niches of the hall, for they are selected for those very places, to make the hall an ensemble equally as much as a setting for the group.

The Hope panels

Large bas-relief panels, beautifully modeled by Mr. John W. Hope, and finished in silver, adorn the darker areas of the case fronts above group openings. Silver, too, is the color note of the mezzanine group fronts. Its life and neutral color serve well the ensemble of the hall, and likewise the group.

The great centerpiece of African elephants will, of course, be the most outstanding and awe-inspiring unit in the hall. As one enters from the Roosevelt Memorial, one sees before him a whole herd of these ponderous beasts. In no museum is there an exhibit to compare with it. Eight in all form the group, four originally mounted by Akeley, and four collected by President Davison and now being mounted by Mr. Robert H. Rockwell, of this department.

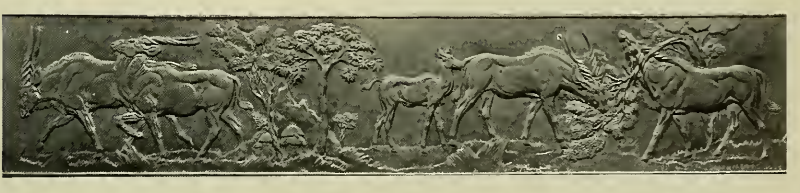
A herd of elephants in itself is an astounding and momentous piece of work to attempt, yet it is but a part of our African Hall program.

Life-size bronzes of African natives, by Malvina Hoffman and others, will stand between groups before the columns, while all is bathed in a diffused light emanating from indirect fixtures in the ceiling.

Jungle light

Upon entering the hall, one finds himself in the deep mysterious lighting of an African jungle. Not a single light opposes the eye, while the groups themselves stand out in a blaze of sunlight, as if one were looking through open windows across a torrid veldt.

Passing from one to another, our visitor sees Africa and its wonders—its roaming animals, its colorful flowers, strange trees and rolling plains and forest jungles. Transplanted Africa stands before him—a result of Akeley's dream.

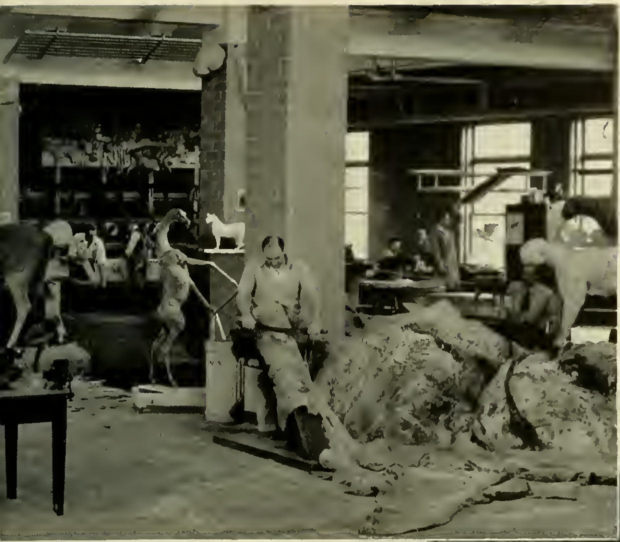


One of the panels modeled by John W. Hope to go in the case front above the groups. This panel adorns the Giant Eland Group.

(Below) Mr. R. H. Rockwell giving the finishing touches to the clay model of the large giraffe for the Water Hole Group

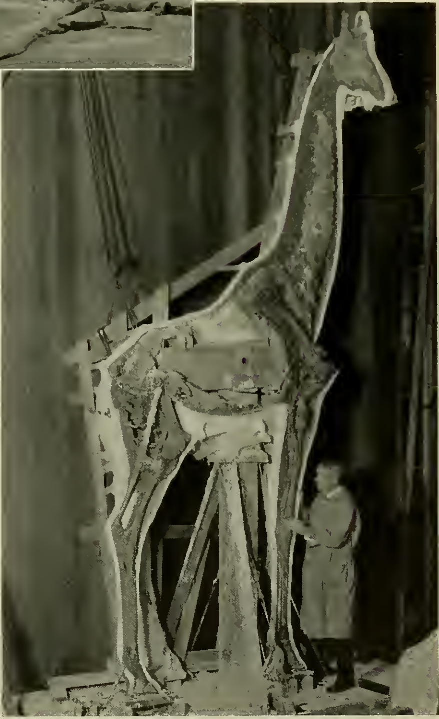
(Above) Activity in the top sky-lighted studio
Museum. Most of the animals shown here in
Hall groups. In the right foreground a prepar
is to become part of the herd of eight elephants

(Below) Detail study of the head of the large bull eland in the Giant Eland Group

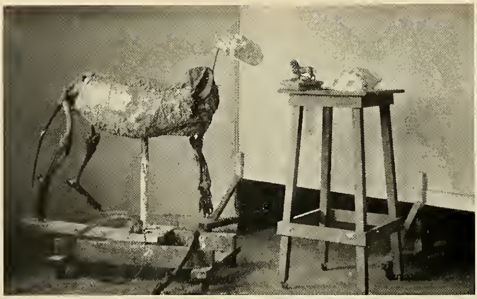


of the preparation department at the American various stages of creation are for the African ator is paring down an elephant's skin, which that forms the central exhibit of the Hall

(Below) One side of the three-piece plaster mold has been removed from the completed clay model of the giraffe

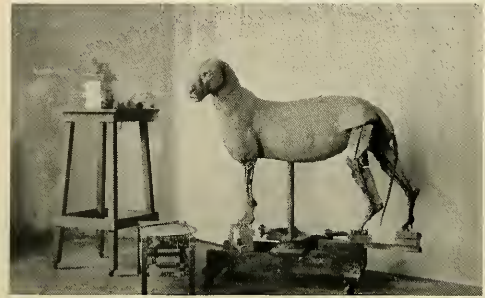


(Below) Detail photographs of newly collected animals are a valuable aid

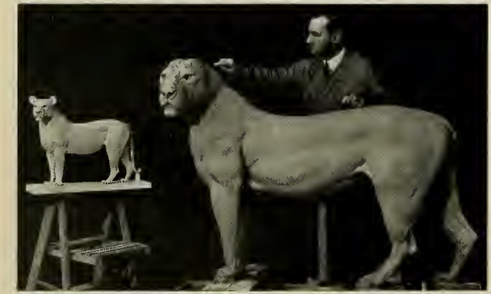


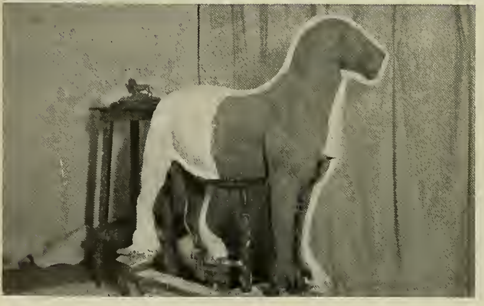
The foundation for mounting an animal is an armature constructed of wire mesh, burlap, or plaster, using the leg bones, skull, and any others that may be helpful in giving the proportions, action, and other characteristics of the individual specimen.

This armature is sufficiently flexible to permit change of action or position at any stage of making the model. Water clay is built up on the armature, using the field measurements as a guide to the accurate reproduction of the animal



RECREATING



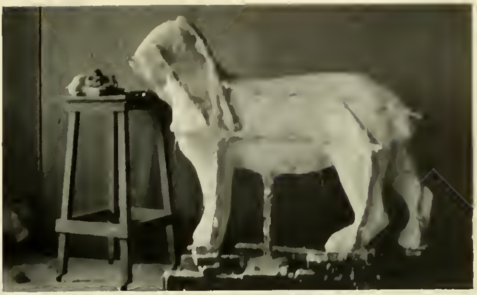


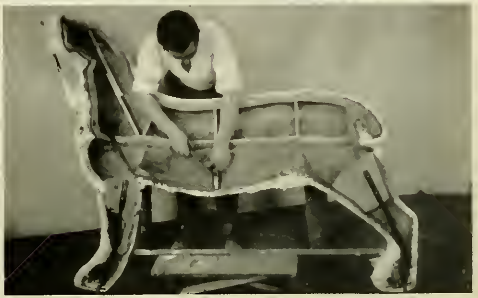
When the clay model approaches completion, the skin is soaked and tried on. Any slight changes that may be found necessary are made after this fitting, and the skin given a final try-on before proceeding with the casting of the model, as shown in the photograph at the lower left.

A plaster mold is made in three pieces and reinforced on the outside, so that it can be removed from the model without breaking, and also make the building of the manikin more convenient

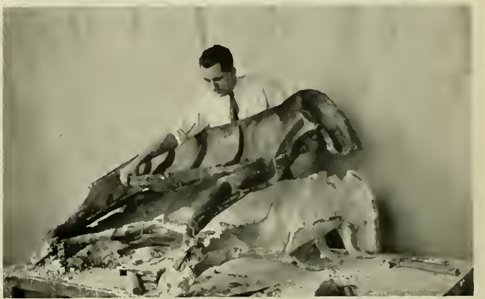
The manikin is built of burlap, wire mesh, and a very durable and hard-drying papier maché, reinforced inside with wood ribs cut to the body form and secured with maché. The burlap is first fitted into the form with glue, after the mold has been sized with glue. Thus, when the form is completed, it may be released from the mold by soaking the plaster with water. The three sections are joined after removal from the mold.

At this point the figure is an exact replica of the clay form



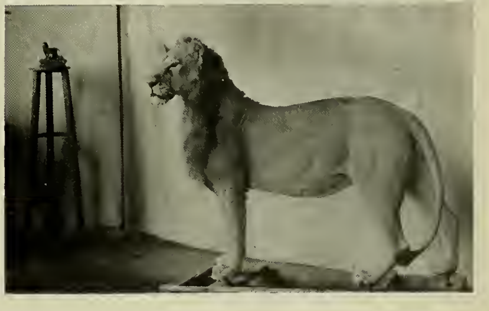


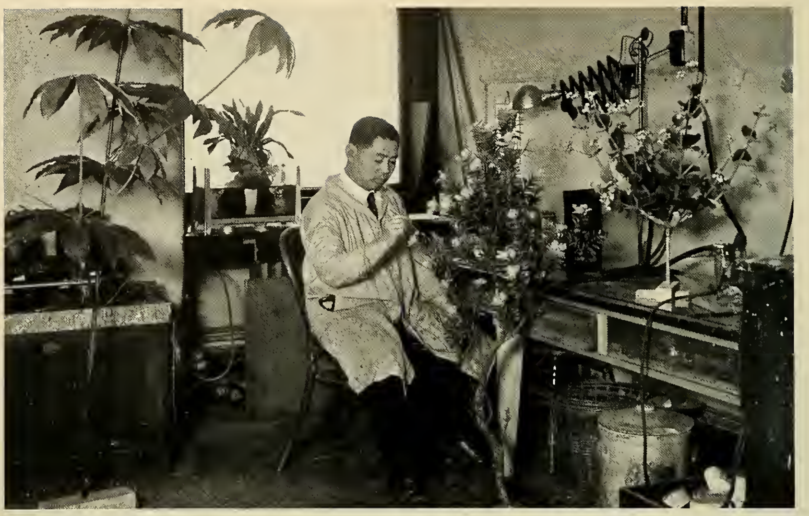
AN ANIMAL



The skin, which in the meantime has been tanned, is now applied to the modeled manikin with a special and enduring maché paste. Soft, slow-drying maché is used wherever necessary to bring out the delicate modeling of veins or wrinkles and details around the eyes, nose, and lips.

The glass eyes are fitted into position with great care after the skin is in place. Finally, with the waxing and coloring of fleshy parts, the mount is complete





(Above) The several plants shown here have been reconstructed in paper, wax, and celluloid by Mr. Narahara, who has had formalin-preserved specimens, photographs, and color notes, taken in the field, to guide him

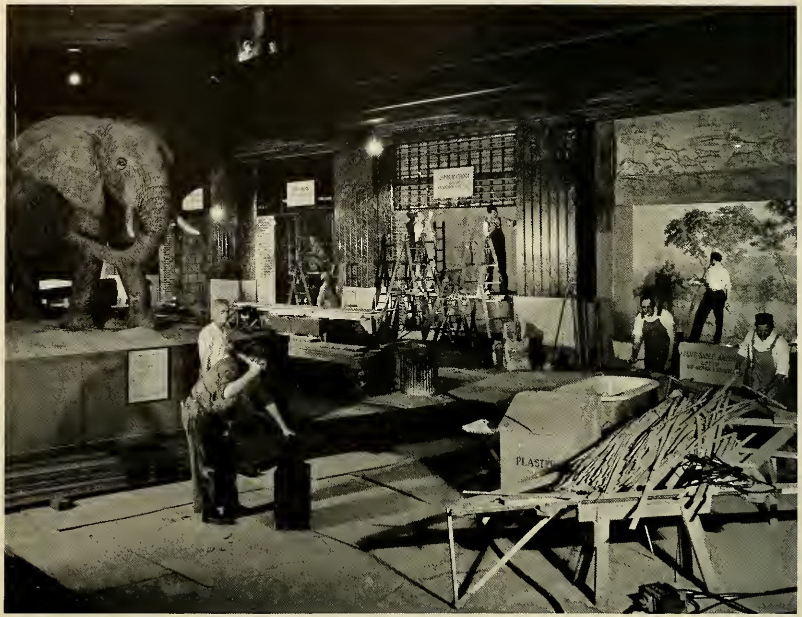
(Right) A close-up photograph of a plant to guide the preparator in assembling the various fabricated parts

A form such as the ant hill shown at the left is too fragile to be shipped without breakage. However, with a few well-preserved samples for texture and with good photographs, the preparator can reproduce the form with impressive accuracy

(Left) This detail of a tree base almost engulfed in an ant hill has been reproduced in the Giant Eland Group

(Right) Trunks of large trees are seldom used in a group, but are modeled in maché over a form built of wood, wire mesh, plaster, and burlap. Photographs of the tree and samples of the bark are all that are needed by the preparator

(Below) Mr. Raddatz, a member of the Eastman-Pomeroy-Akeley African Expedition, is here shown making plaster molds of freshly selected leaves at the field base



In no other museum have whole halls been planned and carried out as a unit. Even while carpenters, iron-workers, and masons are constructing the cases, an artist is at work painting a background. Every available preparator is at work on some part of a group

A study of an African plant

The Water Hole Group

THERE has been an exceptional opportunity in each of the four corners of the Akeley Hall of African Mammals to build habitat groups of unusual size and depth. This has been especially effective in the portrayal of panoramas, mountain vistas, and great game herds. One of these larger exhibits is the Water Hole Group, representing a scene along the Guaso Nyiro River.

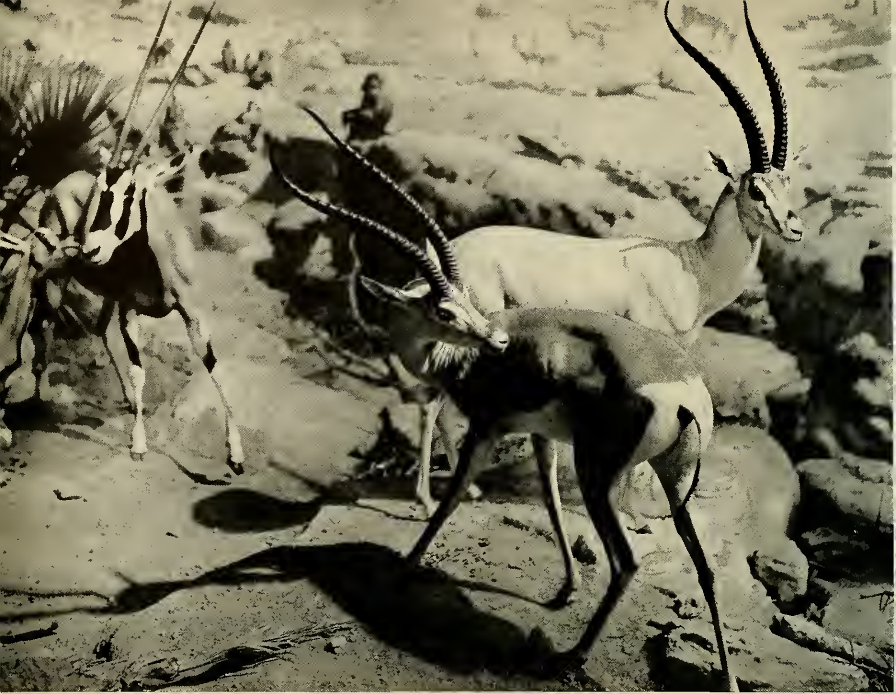
The water hole is to the animal life of Africa what the public square is to a town; it is the center of activity, the focal point of interest. At the water hole the various species come to drink and, social or solitary in disposition, mingle, perforce, with the other animals. Here the beasts of prey naturally find a favorable concentration of potential victims. The African water hole is one of the world's big spectacles of wild life.

In many parts of Africa, where a long, rainless season dries up small streams and practically eliminates available surface water, there will be local areas where the geological configuration provides a supply of water just under the surface of the ground. In such a spot a well or a natural depression will yield water in an otherwise semi-desert environment. Furthermore, this particular spot may afford the only water for a district a great many square miles in extent. Frequently the mammals dig out their own depression, when Nature has not provided one, and when the soil is soft, a series of water holes may be established.

The giraffe (the subspecies shown is the reticulated giraffe, *Giraffa camelopardalis reticulata*), in comparison with other mammals, seems to be a misfit, a caricature of the normally proportioned animal. At the water hole the long forelegs seem especially awkward, for the giraffe cannot get its head down to the ground level, much less to a depression below, without spreading the forefeet wide apart, and it is fortunate that its neck is so long.

There are a great many varieties of African gazelles but the Grant gazelle (*Gazella granti*) is one of the best known and most easily recognized. It is the largest of the African gazelles and there are quite a few sub-species or geographical races, the one shown in the group being *Gazella granti raineyi.*

Most of the gazelles are plains or open country antelope, preferring the wide, open spaces to the forested areas. A few species work upward into broken country, follow valleys up into the mountains, or find congenial environment on an elevated plateau. The Grant gazelle wanders with the great assemblage of game that roams upon plains more or less well-grassed, with thorn scrub and occasional sparse forest growth.



Gift of Mr. George Eastman.

Animals *by Robert H. Rockwell, John W. Hope, and Louis Jonas.*

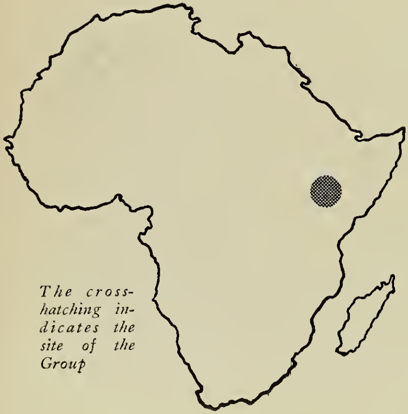
Background *by Wm. R. Leigh.*

Flora and Foreground *by Albert E. Butler, assisted by George F. Mason, Joseph M. Guerry, and Carlton McKinley.*

Birds *by Raymond B. Potter.*

Direction, *James L. Clark.*

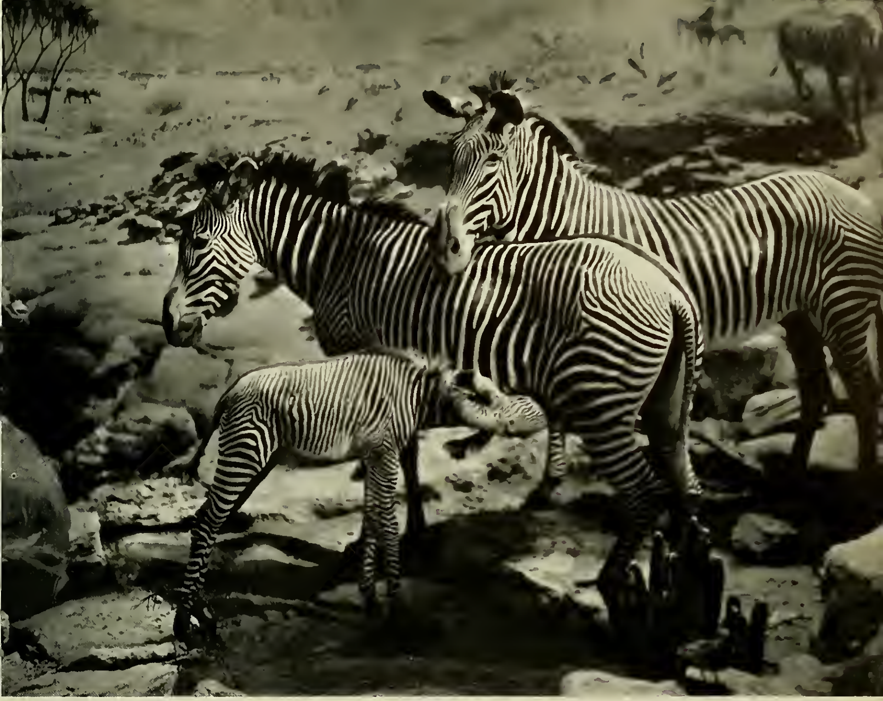
Scientific direction, *H. E. Anthony.*



The cross-hatching indicates the site of the Group

As is true of so many plains antelopes, the Grant gazelle relies upon its fleetness of foot to escape from its enemies. All its senses are keen, its power of vision being especially good, and it does not attempt to hide or to seek cover. Since there is so little cover which would hide a gazelle in most of the country frequented by these animals, the ability to keep well in the open from a predatory animal is the all-important factor.

The heisa shown about the water hole are of close kin to the gemsbok, the oryx featuring another group in the African Hall. The particular subspecies in the water hole group is *Oryx beisa annectens,* a variety ranging from the Tana River to the border of Abyssinia.



Beisa show a preference for dry plains where they can feed in open stretches of grassland. They may also be noted in areas dotted with low, thorny scrub. They travel in bands of as many as fifty individuals, but more often are seen in small groups. A herd is controlled by an aggressive old bull which keeps less powerful males out of the company until such time as a newcomer is able to drive him out to wander alone or with another outcast like himself.

Not only do the mature males fight actively among themselves, but they are not slow in turning their long, sharp horns against other species. In this reliance upon their natural weapons, both sexes compel respect from the other mammals, and a wounded beisa must be approached very cautiously and with the expectation of a charge.

In most of its behavior the beisa conforms to the usual pattern of dry plains animals, most active morning, late afternoon, and night, relying upon good vision, powers of scent and speed for protection from enemies, and possessing an ability to lead a successful existence with very little water.

The Grevy zebra (*Dolichohippus grevyi*) may be used as a representative of the rather large group of African zebras, although it has certain anatomical characteristics which the specialist uses to set it apart from the other striped horses. To the layman there is an affinity of relationship denoted by the conspicuously striped pelage and the compact horselike build of the zebras which makes it easy to identify one of these animals at a glance.

The zebra is one of the favorite food animals for lions, but despite the inroads of predatory animals, the zebras occur in great numbers over a large part of Africa. The Grevy zebra is essentially a plains type, grazing on the dry grasslands and through districts where no heavy forest occurs. It ranges from southeastern Abyssinia south to the Tana River. It usually travels in bands of from five or six to several hundred animals.

The Grevy zebra is much larger than the Grant zebra and has more stripes. The two species may be found, sometimes, in the same territory and even mingle in a common herd.

—H. E. Anthony

Future Plans for the

By F. TRUBEE DAVISON
President, American Museum

AFRICAN HALL, as it stands today, is a splendid memorial to Carl Akeley and a living testimony to the generosity of those who gave their time, thought, and funds to the realization of his magnificent vision.

Still, superb as it is, the Hall is but partly completed. Only half the number of groups which eventually will be housed in this latest and loveliest of all Museum halls, have been collected and installed.

Out of the total of twenty-eight groups that have been planned, fourteen are financed and only ten are really completed. The remainder, fully as interesting and important as those now provided for, await the sponsorship of those who would like to lend a hand in the effort to perpetuate within the protecting walls of the American Museum a cross section of the Africa which Akeley knew and which is rapidly disappearing.

It may be well at this time to give a brief outline of the habitat groups still unprovided for in the Museum's African Hall project. They include black rhino from Kenya, addax from the Sahara Desert, okapi from the rain-soaked forests of eastern Congo, mandrill monkeys from the coastal regions of West Africa and the spectacular Colobus monkey which is not only celebrated for its beautiful markings but also intensely interesting from a biological standpoint.

Among other interesting groups which we hope to create in the African Hall are the following:

A scavenger group which would show a typical African scene with the scavengers of the veldt, such as vultures, marabous, jackals, and hyenas converging upon the remnants of a lion kill.

A leopard group which would show one preparing to attack its prey—perhaps a red river hog. In that way we would show two animals—the leopard and the hog—in their natural setting. Pigs are a favorite prey of

A preliminary plan for the Lesser Koodoo Group, one of the miniature sketch models designed for the mezzanine of the Akeley African Hall

leopards, and the red river hog is a very spectacular member of the pig family.

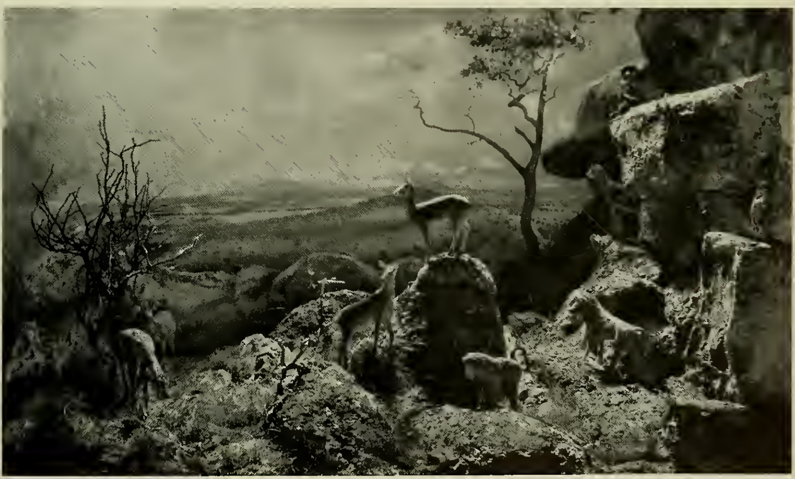
Although the ostrich is a bird naturally to be sought in a bird hall rather than in a hall devoted to mammals, still it seems proper to include one or two members of this interesting family in one of the groups. There are several reasons for this. The first is that the ostrich occupies a permanent place in the public mind in connection with Africa; and secondly, it is considered as big game by most people who travel in Africa. The picture we plan might, for instance, show a male bird with his head down and his wings spread, driving off a family of wart hogs which happens to be passing too close for comfort.

Of course, African Hall would not be complete without a group of chimpanzees showing how these great apes live in the treetops of the West African jungles. This group would give a vivid picture of their family life, the nests they build and the food they eat. It would afford an interesting comparison with the great Gorilla Group which is already completed. Also to be mentioned is a cheetah group depicting this very interesting animal which has the appearance of a cat but has claws like a dog and is one of the fleetest animals alive. This beautiful creature is like a leopard, but has long legs, and the spots on its coat are a series of black dots instead of broken circles.

Others who have writtten articles on Africa and the Akeley Hall of African Mammals for this issue of NATURAL HISTORY have presented a far more detailed picture of the American Museum's aims and interests in this connection than it is possible for me to do, but I want to point out that in African Hall we strive to do much more than merely keep a record of the animals of Africa. Each group is not alone an exhibit of the type of animal it features, but it is a complete cross section of the region, which reveals the geology, botany, bird, and reptile life of the region. It goes so far as to cover even the meteorological features such as characteristic types of clouds.

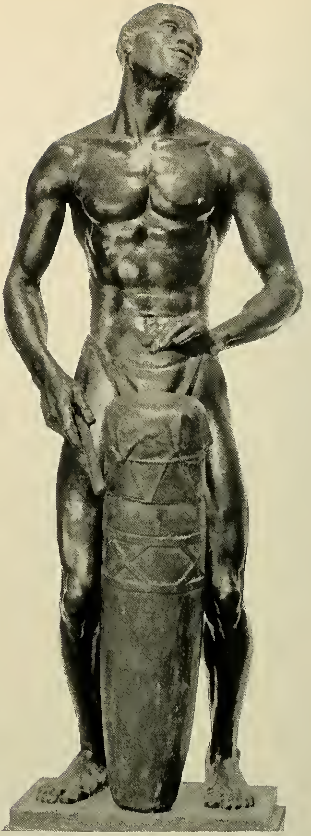
When Akeley dreamed this hall, there were but very few who realized that it was possible

A miniature sketch model of the Klipspringer Group, one of the fourteen planned for the mezzanine of the Akeley African Hall

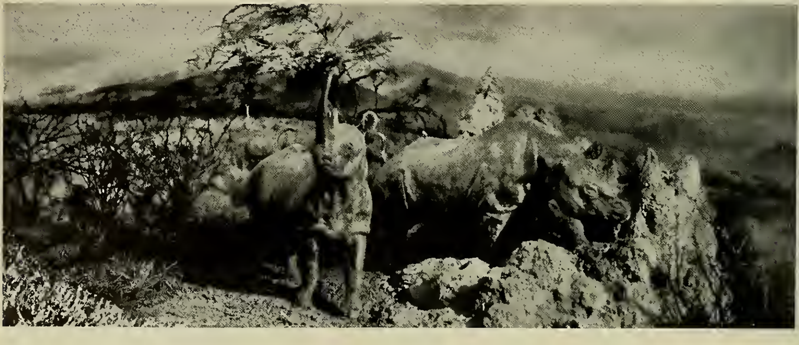


for the great herds of game to shrink and for the abundance of animal life to dwindle. Only a few men, like Akeley, seemed to realize that a large part of this animal life will eventually disappear and that something must be done to preserve their record. This was what stimulated him to dream this great hall and, now, his associates who appreciated his foresight begin to realize that the end Akeley predicted is not as remote as many people thought. In fact, in spite of drastic conservation measures, the magnificent game animals are being destroyed. It is not so much sportsmen who kill the game as it is the advancing wall of humanity as it expands over the surface of the globe and enters hitherto remote sections, looking for new and tillable lands. Unfortunately, big game and man cannot live together, and even National Parks in Africa, similar to those in the United States, do not eliminate problems in the saving of game within these protected areas.

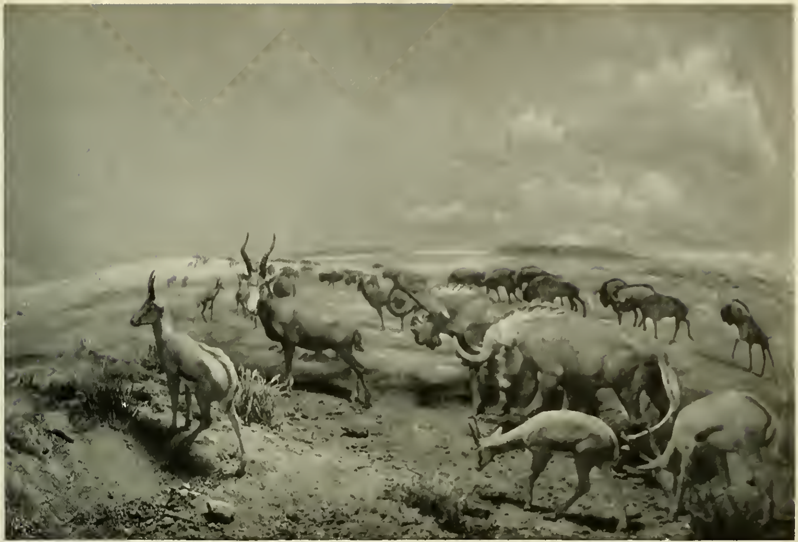
Hand in hand with conservation goes the work of the American Museum of Natural History and similar institutions to preserve for posterity an accurate picture of Africa. All things change, even Africa. The "Dark Continent" of Stanley's day became the "Bright Africa" of Akeley's time. Probably the period is not remote when cities and plantations will



(Right) The bronze figure of a tom-tom drummer which will add a human element to the African Hall. It is the work of Malvina Hoffman and the gift of Mr. George D. Pratt



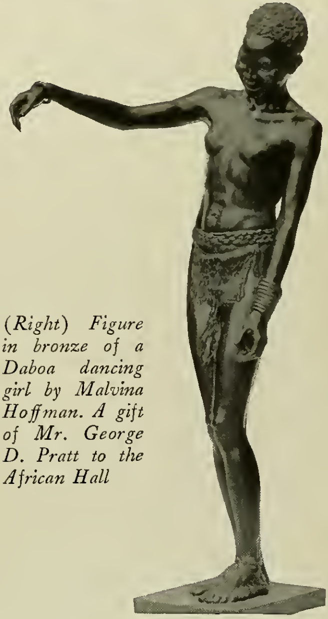
(Below) A miniature sketch model of the Black Rhino Group. These animals would have to be collected in East Africa



(Above) A miniature sketch model of the South African Group which would include specimens of springbok, wildebeest, and blesbok. All of these animals are now extremely rare and rigidly protected by law

conquer nature and primitive life on the veldt. The situation in Africa is somewhat like our own in this country. Years ago huge herds of buffalo and other game roamed the western plains. Today the herds are almost gone, and it is the advance of civilization that has destroyed them. The same is bound to happen to Africa, and that is why it is so important that our educational institutions make available for millions of people who never will see Africa, as well as for the generations that are to come, an accurate, beautiful, and instructive picture of African wild life, before it is too late.

I am proud to predict that the Akeley African Hall of the American Museum will be the finest of its kind—a memorial to a frontier that won the hearts of men such as Akeley, but the Hall is only partly complete as it stands today, and I sincerely hope that funds to finish this magnificent picture of an Africa that some day will exist no more will be forthcoming in the near future.



(Right) Figure in bronze of a Daboa dancing girl by Malvina Hoffman. A gift of Mr. George D. Pratt to the African Hall

Science in the Field and in the Laboratory

Expeditions, Astronomy, Education, Nature Trails, Fish, New Publications

Edited by A. KATHERINE BERGER

The Third Scarritt Expedition

The Third Scarritt Expedition of the American Museum of Natural History, sponsored by Mr. H. S. Scarritt and led by Dr. G. G. Simpson, worked for four months in central Montana last summer and the results are now being worked up at the Museum. With the assistance of Mr. A. C. Silberling, an able and well known local collector, two fossil quarries were opened and extensively worked, both at sites previously discovered by Mr. Silberling, and many other localities were examined. About 1,500 specimens of fossil mammals were discovered, of which 635 include considerable parts of skulls or jaws. Mr. and Mrs. Fenley Hunter of Flushing worked with the party during June, and Dr. Walter Granger and Mr. Albert Thomson, of the Museum staff, also worked in the field later in the summer. Mr. F. Trubee Davison, president of the Museum, and Mr. Scarritt also made shorter visits to the camp.

The summer's collection is one of the most important of early mammals ever made. It consists of remains of extinct animals that lived almost at the beginning of the Age of Mammals, some 50,000,000 years or more ago, and so casts light on many problems of the origin and early history of the mammals. The work of freeing the tiny and delicate fossils from the rock in which they were found is being done by Mr. Thomson, and will take many months. Until this is complete, it will be impossible to say exactly what is included in the collection, but from what has already been done it appears that about seventy-five species are probably represented, many of them new. Perhaps the most interesting of these are the primates, the oldest members of the group to which man himself belongs ever to be discovered anywhere, represented by many fine specimens in the new collection.

Most of the fossils collected in Patagonia, South America, in 1933-34 by the Second Scarritt Expedition, have now been prepared and are being studied, and one, a fine skeleton of a new animal named *Scarrittia*, has been placed on exhibition.

Astronomy and the Hayden Planetarium

On Sunday January 5, the regular monthly change of program takes place in the Hayden Planetarium schedule, when the new lecture on the winter constellations will be given at the first afternoon lecture at two o'clock, and from then on during the entire month. This lecture will include a general discussion of constellation figures and mythology, dealing in particular and in detail with those of the winter skies. In addition to pointing out the figures of the constellations, the lecturers will tell the age-old stories connected with the various star groupings.

During the first two months in which the Hayden Planetarium has been open, more than 220,000 persons have attended the performances given there.

There will be a meeting of the Amateur Astronomers Association on Wednesday evening, January 15, at 8:15 o'clock, when Mr. James Stokley, director of the Fels Planetarium in Philadelphia, will speak on the subject "New Eyes to the Heavens." This will be an illustrated lecture, open free of charge to all those interested, and held in the large auditorium of the American Museum of Natural History, 77th Street and Central Park West.

Prize-winning posters

The thirty-eight prize winning posters, submitted by art students in the high schools of Greater New York in the Hayden Planetarium Poster Contest, have been placed on view in the Hayden Planetarium. In all, 351 posters of excellent quality were entered in the contest from twenty-eight schools in the five boroughs. The posters were judged by a group of well known artists—Mr.

Wallace Morgan, Mr. Lucian Bernhard, Mr. Thomas Benrimo, and Mr. Fred G. Cooper—who kindly served, together with members of the American Museum staff. The prizes, which were art materials attractively boxed in specially made blue boxes covered with silver stars, were generously donated by Binney & Smith. The prizes were presented by Doctor Sherwood in Education Hall on the afternoon of November 26.

Travel sketches

From December 24 to January 12 a series of travel sketches by Carl Werntz entitled "Other Peoples, Other Places" will be on view in Education Hall.

Free motion pictures

The series of Saturday afternoon free educational motion pictures for 1936 will start on January 4 with the film "When Winter Comes." "Alexander Hamilton" will follow on January 11; "Animals—Wild and Not So Wild," on January 18; and "Fish Tales" on January 25. In February the pictures will be "Vincennes," "Bottom of the World," "Abraham Lincoln" on February 15, "George Washington" on February 22, and "Wolfe and Montcalm." This program will run until June 27.

Members' lectures

Dr. Wilfred Osgood of the Field Museum of Natural History will give the first of the spring lectures to Members on February 13. He will speak on "Ethiopians and Their Stronghold." On February 27, Mr. Arthur C. Pillsbury will give the second lecture in the series, "Growing Plants Without Soil." The course for children of Members will be opened on February 15 by Mr. Charles Crawford Gorst, speaking on birds and giving his fine imitations of their calls and songs.

Junior Science Clubs

In coöperation with the American Institute of the City of New York, the American Museum entertained the annual Science Congress of Junior Science Clubs of the American Institute on December 26 and 27. The American Institute arranged several special Christmas lectures in connection with the Congress, the speakers being: Commander Charles E. Rosendahl, Commanding Officer, U. S. Naval Air Station, Lakehurst, N. J.; Dr. E. C. MacDowell, Department of Genetics, Carnegie Institution; Dr. W. F. G. Swann, Director of the Bartol Research Foundation, Swarthmore, Pa.; Captain Albert W. Stevens, U. S. Army Air Corps, Flight Commander of 1935 Stratosphere Flight. The talks were broadcast from the Museum auditorium over WEAF.

Bear Mountain Nature Trails

The winter program of the Bear Mountain Trailside Museums and Nature Trails includes several new types of activities. Work is going forward on two relief models to be placed in the Trailside Historical Museum. The models will show the routes taken by British troops in the attacks upon near-by forts Clinton and Montgomery during the American Revolution. Excavation carried on, during the fall, in the West Redoubt of Fort Clinton, revealed valuable information that will aid in the construction of a miniature restoration of the ramparts.

A collection of sixteen species of local fish has been added to aquariums in the Zoological Museum. This exhibit is now housed in the Botanical Building. Fourteen species of small mammals, twenty-one reptiles, and many insects, crustaceans, and amphibians, all local, are on display at present.

The Orange County Science Teachers' Association meet at the Trailside Museum on alternate Sundays for the purpose of attending conducted hikes in the interior of the Bear Mountain-Harriman Section of the Palisades Interstate Park. These walks are designed to acquaint teachers with out-of-door facilities for nature study. Several iron mines have been visited and, in the near future, journeys will be made to beaver ponds and to other points of interest. The teachers are permitted to collect material for classroom use.

In connection with studies of the mammal life of the Hudson Highland area, carried on for the past nine years, nightly excursions by automobile are made into the interior of the park when weather permits. Powerful spotlights are used to aid in the observation of nocturnal animals. The problem of the distribution of white-tailed deer is of primary interest in this survey. It has been determined that many individual deer occupy approximately the same territory during the winter months. The record number of deer, observed in a single night along forty miles of highway, is sixty-two. In an attempt to encourage the animals to remove themselves from close proximity to the highways, three hundred pounds of salt have been distributed in the more remote sections of the Park.

—W. H. Carr

James Henry Breasted

Prehistoric archæology sustained a serious loss in the death, on December 2d, of Prof. James Henry Breasted of the University of Chicago.

Professor Breasted was not only a teacher of ancient history and of Egyptian and Oriental languages, but as director of the Oriental Institute he promoted archæological research in Egypt and the Near East on a larger scale probably than any other man. Naturally he was concerned chiefly with the advanced cultures of early historic times; but, fortunately, his interest did not stop there. As proof of this he prefaced his textbook, *Ancient Times* (1916), with a brief but well balanced chapter on "Early Mankind in Europe." A few years later, in 1919, he presented a lengthy paper before the National Academy of Sciences in Washington, entitled *The Origins of Civilization*, in which among others things he sought to show that the Neolithic culture in Egypt dates back to about 18,000 B. C. His alleged facts, namely, the repeated occurrence of artifacts in the Nile Valley silts down to a depth of as much as eighty feet, so far as known have never been disputed; but they appear to be ignored by several recent writers, who would place the beginnings of the Egyptian Neolithic as late as 6000 B. C. In the meantime, however, Breasted directed an extended investigation in the Nile Valley and the adjacent Faiyum Basin, having for its object the correlation of Paleolithic implements with the prominent gravel terraces. The field work, carried out by K. S. Sandford and W. J. Arkell, two English geologists, was continued for a period of years and the valuable positive results have been published by the Oriental Institute in two sumptuous volumes.

In view of such accomplishments it is regrettable that Professor Breasted could not have lived long enough to have instituted a similar survey for the great valleys of Mesopotamia. However, as a result perhaps partly of his efforts, much intensive archæological work has recently been carried out, particularly in Palestine; but whether this is so or not, prehistoric archæology must forever be indebted to Professor Breasted, who saw man and his culture as a single phenomenon and who did much to clarify it.—N. C. N.

A Striped Marlin

The department of fishes of the American Museum has received the skeleton and fins of a striped marlin from Mr. Templeton Crocker who secured it at their request, on a recent trip to Lower California. Compared with similar material of the blue marlin already in the Museum collection, this fish is seen to have a more slenderly tipped smoother spear, longer, more pointed lower jaw, straight versus curved pectoral fin, the front rays of the dorsal and anal fins less heavy and these fins less pointed. Its relationships are evidently with the Atlantic white marlin rather than with the blue or others of the black marlin group.—J. T. N.

Early European Civilization

The Library of the American Museum has received from the New York Academy of Sciences Luigi M. Ugolini's recent work entitled *Malta, Origini della Civiltà Mediterranea.* The volume is illustrated by 114 text figures, many beautiful full-page plates, and a map. It is an interesting and welcome addition to the Library's collections on early European civilization.

Appointment

Dr. J. Eric Hill has been appointed assistant curator of mammals at the American Museum to fill the vacancy created by the resignation of Dr. Robert T. Hatt. At the time that Doctor Hill was appointed he was engaged in the study of special mammal problems under Dr. Joseph Grinnell, director of the Museum of Vertebrate Zoology, University of California. Doctor Hill is a graduate of the University of Kansas of 1931. He has spent several summers in the field for the University of Kansas, as well as in California, Oregon and Manitoba, on his own account. Doctor Hill has published a note on a new amphibian from Kansas and several other short papers on rodent anatomy. A report on the pocket gophers of the Lower Colorado Valley will be published shortly in the Journal of Mammalogy as a joint article by Dr. Joseph Grinnell and Doctor Hill.

Recent Museum Publications

BULLETIN

Vol. LXVIII Art. VIII.—Results of the Archbold Expeditions. No. 7. Summary of the 1933-1934 Papuan Expedition. By Richard Archbold and A. L. Rand.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum:

Patrons

Mrs. Harry Snyder
Miss Dorothy Jane Snyder
Messrs. William D. Campbell, Willard H. Carr, Dean Sage, Ernest Shoemaker.

Fellow

Mr. Charles T. Wilson

Life Members

Mrs. Alfred G. Kay
Dr. J. Warren Bell
Mr. Melville P. Cummin

Sustaining Members

Mrs. Evelyn W. Adams
Messrs. James H. McGraw, George F. Singer.

Annual Members

Mesdames George A. Beardsley, Ethel Clyde, J. Clarence Davies, Clifton V. Edwards, Reginald E. Gillmor, R. M. Gunnison, Charles H. Hampton, Anna C. Jefferson, H. S. Manges, E. M. Murtaugh, Charles H. Talcott, E. C. Vogel, June E. Willis.

Misses Blanche Adler, Dorothy M. Blondel, Sybil M. Boland, Martha Carlson, Frances H. Dickerson, Christina M. Koehler, Ruth Lees, Christine M. Nilsson, Dorothy S. Nye, Beryl Parker, Phyllis Stanley, Ethel G. Stringfellow, Gertrude R. Wilson.

Doctors Martin Biederman, J. de Raismes Combes, Joseph Hajek, Robert M. Stecher, D. E. W. Wenstrand, Paul M. Wood.

Professor George G. Scott

Messrs. K. C. Atwood, Jr., William Felton Barrett, Aaron W. Berg, Robert O. Blair, Clayton P. Chamberlin, Alfred W. Church, Bernard Easterson, Ernest A. Edwards, Lanius D. Evans, Thomas B. Frank, Frank J. Fuhrmann, Howard S. Gans, G. Jarvis Geer, Francis Greer Goodman, John Henry Hammond, Joseph B. Hare, Chas. J. Hendrickson, William H. Hosford, Henry N. Jasper, Jonathan T. Lanman, Paul A. Lynch, Rowland R. McElvare, Francis W. Powers, Wm. A. Prendergast, John K. Prentice, Edwin H. Ranges, H. H. Roth, Frank L. Skeldon, Melvin Spencer, Charles N. Teetor, Lewis J. Trounstine, Herbert Waller, Arthur K. Woodman.

Associate Members

Mesdames Joseph J. Benjamin, B. R. Billings, Frances B. Bostwick, G. C. Bourne, Caroline M. Brown, William H. Bryan, Anne Cornell, Alan C. Doig, Peter Dolese, Helen W. Fields, D. D. Fischer, A. D. Foster, W. M. Garton, W. J. Gluckert, Henry T. Hall, Marjorie Hart, Robert Parsons Howell, Marion S. Jones, Frieda Keferstein, Leona M. Lee, Wilfred L. Letendre, J. Wallace McKenzie, Geo. W. Murray, A. E. Otto, L. C. Pardee, Edith Parish, Charlotte B. Perry, Anna Fairfield Pevoto, George J. Puckhafer, J. L. P. Robinson, W. A. Savage, Barbara M. Scholding, H. M. Spandau, Robert H. W. Strang, B. M. Walpole, C. W. Williams, John D. Williamson, Ira M. Young.

Mother Teresa

Sister Margaret

Misses Constance Avery Atwater, Mary Compton Aymar, Cora A. Beard, Marie Brahdy, Mae Carden, Kathryne E. Cooksey, Maybell Criner, Anna M. Cronin, Ethelwyn Doolittle, Helen B. Dorsheimer, Grace Eldridge, Frances R. Ferris, Elizabeth W. Fisher, Nellie D. Fisher, H. Forbes, Edith E. Giles, Dulcie E. Greenwood, Harriett L. Hamilton, Josephine S. Hannaford, Blanche B. Hanson, Edith Guild Henderson, Zada E. Herrick, Virginia L. Houghton, Ruby M. Jolliffe, Eleanor M. Kelly, Emma S. Kumfert, Stella Lefever, Nancy Lloyd, Nancy Norman, Nellie R. Nye, Marion T. Pleasants, Blume Regenbogen, Edna B. Richter, Alice T. Rowe, Vera M. Sakemiller, Charlotte Schuchardt, Ann Carter See, Ruth K. Shaw, Catherine Smith, Viola M. Sohn, Effie M. Sutch, Charlotte L. Timmerman, Marion B. Warren, Lena R. Wellington, Jane A. Wilson, E. Frances Woodward.

Reverends Francis S. Majewski, Thornton B. Penfield, Otto Wendell.

Doctors Fred J. Badger, P. F. Brabec, Harry D. Brice, James B. Conant, H. F. Dailey, Michael Epstein, George Garthwaite Fisher, Lloyd W. Fisher, Harry W. Gauchat, Charles W. McClure, L. G. Morah, Wm. H. Park, Olin Sewall Pettingill, Jr., Myron A. Roberts.

Professor Carroll L. Courtney

Captain David D. Graves

Messrs. Richard N. Adams, R. J. Anderson, Stanley Arnold, Edwin Montgomery Bailey, Sr., Robert H. Baker, John E. Ball, Wm. Wallace Bancroft, Edward J. Banker, E. J. Bartlett, Ernest A. Batkins, Wm. S. Behrens, Fred Blumenthal, W. Chester Bottome, F. M. Boyce, Harry B. Braun, R. C. Casselberry, Eustace M. Chamberlain, C. A. Clapp, John Dodge Clark, Robert D. Coghill, Paul Connor, Harward W. Cram, Perry Davis, Joseph Dellapent, John A. Denison, Robert D. Denton, Nicholas Dietz, Amos F. Dixon, Ransom W. Edwards, Humphrey N. Ervin, James McNelledge Fadeley, Richard A. Fayram, Ruurd G. Fennema, Wayne H. Fisher, Jr., Robert G. Foster, L. Woodward Franzheim, Robert W. Fuller, Frank J. Garrett, Peter Dunne Garvan, F. A. Gaylord, H. M. Giffin, G. M. Goodman, Albert P. Gresser, Wm. H. Hampton, Wm. Albert Harbison, Russia Harris, William F. X. Harrison, Einar Hille, Samuel F. Holmes, Jonah H. Honig, Charles J. Hudson, Forrest R. Hughes, Ralph B. Hurlburt, Chester D. Jones, H. Thorn King, Jr., Samuel Knox, Charles F. Koughan, Frank H. Lamb, Louis Laroche, John E. Layton, Harold Levy, Arta Lewis, David C. Liebler, Arthur Long, Clarence Lyon, Frank S. Magee, Benjamin W. Morris, Jay Robert Morton, Ernest Mutschler, George Hewitt Myers, Charles E. Neil, Leslie F. Nims, Bobbie Novotny, John J. O'Connor, Edward O'Neil, Austin H. Parker, James Parker, Jr., Edgar H. Parkman, Y. C. Paschall, Harold C. Paull, Van Kirk B. Perkins, Rutherford C. Plaut, Allan K. Poole, Jr., Dewey M. Price, A. D. Purdy, J. A. Putnam, K. I. Rainesalo, William D. Reichmann, H. E. Riddleberger, John O. Roach, Lucien F. Rose, Lowell W. Saunders, Harrison M. Sayre, Emil Maro Schleicher, Oswald Schlockow, Julian E. Schonnegel, Max Schwabacher, R. Seibel, Henry B. Sell, Eugene Sheldon Shreve, Edwin G. Shuttleworth, W. H. Singer, Jr., Philip Holmes Smith, Merrill Snyder, Wm. H. Spahn, Joseph C. Spang, Clarence J. Stay, Theron D. Stay, Harry Stevens, William H. Stoffel, Harvey L. Sweetman, John A. Sweetser, Jr., R. P. Tappenden, Max Theiler, Glenn S. Thompson, Charles H. Topping, Charles T. Trace, Alfred W. Tyrol, Jr., R. S. Underhill, Norman J. Vile, John P. Wadham, Bradford H. Walker, Joseph A. Weber, John Hallock Welsh, G. W. Wharton, Jr., Wynant Wilday, Earl B. Wilkins, James Willits, Seth Wilson, Clement B. Wood, E. G. Woodbridge, Alex Wooden, John G. Woodruff, Harry A. Wright, Daniel D. F. Yellott, Jr., Charles H. R. Young.

Reviews of New Books

Exploration, The Animal Kingdom, The Sea, Photography, Primitive Peoples

EXPLORING TO-DAY. *By Lincoln Ellsworth. Dodd, Mead & Company, N. Y., 1935, Octavo, 194 pp. Illustrated.*

SHORTLY before starting on his present hazardous Antarctic Expedition, Lincoln Ellsworth finished the writing of a book, *Exploring Today*, which should be in the hands of every youth and would-be explorer. In the course of the sixteen chapters, Ellsworth relates the trials and tribulations that he had to overcome before he became an explorer. He reveals that exploring expeditions today have definite objectives and that the personnel is, for the most part, highly specialized. Furthermore, he tells in detail just what an explorer's job consists of, how to prepare for it, and how to carry on. He dwells also upon the value of exploration to mankind. His advice to those who want to become explorers is to study the subjects in which they are particularly interested, and supplement this with such field work as can be arranged at or near home. The most interesting part of the book is the experiences of a selected group of explorers as told by the explorers themselves. The book is well printed, well illustrated, and timely.—CHESTER A. REEDS

OVER AFRICAN JUNGLES. *By Martin Johnson. Harcourt, Brace & Co., New York. 1935, 263 pp., 100 photographs, $3.75.*

THIS latest account of the doings of Osa and Martin Johnson lives up to the expectations aroused by the earlier books and pictures of this much-traveled pair. In an excellent specimen of the book-maker's art, profusely illustrated by splendid photographs, and written in an entertaining manner, the Johnsons "go places and do things."

Over African Jungles is the story of the last expedition to Africa from which Martin Johnson brought back the film which later appeared under the title of "Baboona." The Johnsons have had a long experience in Africa and have known all of the methods of transportation. They have progressed by stages from travel afoot to the comparative luxury of motor transport, but in this last undertaking they achieved the ultimate in travel by utilizing the airplane—two of them. The author brings out in a graphic account the great advantage to be derived from the use of the airplane. A journey which demanded 160 days from Stanley, at the cost of great discomfort and even the lives of many of his retinue, can be traversed in comfort, if not actual luxury, in a mere matter of hours.

The Johnsons lead an exciting existence and they do so many interesting things that it is difficult to select specific episodes for comment. Each day in the field has its program of activities which may vary from the physical transport of the party over vast stretches of wild country—an event of itself to thrill most people—to plans for an intimate association with wild life incident which may lead to all sorts of fast-moving and even dangerous developments. Threatened charges by lions and rhinoceroses seem to be a commonplace, and every now and then the charge becomes more than a threat, as might be expected when individuals insist on prying as deeply into the intimacies of African wild life as do the Johnsons.

The travel by airplane involved in *Over African Jungles* comprises 60,000 miles and the itinerary was sufficiently varied to present a cross section of animal life, including the native peoples, from the dry, desert lowlands to the high peaks. Certain features were planned for this expedition, among which might be mentioned the return visit to the pygmies of the Ituri Forest where the Johnsons had made friends on an earlier expedition, rambles among the lions on the Serengetti Plains, flights about the snowclad peaks such as Mt. Kilimanjaro, and the filming of a baboon colony later to be staged in "Baboona."

The text is written in an easy, narrative style, but it seems to this reviewer, at least, that the presentation might have been a little better planned; and if the chapters had been given definite headings, it would have been easier to keep track of the chronological sequence of the expedition. However, this is, perhaps, of no great moment to the average reader who will be carried along by the story without any disturbing reflections upon sequence in time or place; it is only a reviewer who is forced by the nature of his assignment to card index and find a reason for everything. Suffice it to say that the reader will find *Over African Jungles* a book not only interesting to read but one in which he can feel a pride of permanent possession.

—H. E. Anthony

The Mammals of Connecticut. *By George G. Goodwin. State Geological & Natural History Survey Bulletin No. 53, State of Connecticut. 1935, 221 pp, 33 plates, 19 fig.*

The mammals of the Atlantic Seaboard have scarcely received their due share of attention in the recent writings of naturalists. Perhaps this is due to the fact that it is taken for granted that the mammals of the most thickly settled section of the United States are so well known and so much has already been said that it would not be worth the effort to carry out an intensive study of them at this late date. It is a common failing of human nature to be so interested in the far horizon that the things of value in one's own dooryard are completely overlooked. It is a fact that we still have much to learn about our eastern mammals, and the field is far from exhausted. For this reason it is particularly gratifying to note the appearance of Mr. Goodwin's comprehensive report on the mammals of Connecticut.

This volume is by all odds the most complete and the most satisfactory work on the mammals of any of our northeastern States. The basis for this report is data secured by several seasons of field collecting and by a careful search of literature and all available records. Because Connecticut has lost some of its original fauna such as the wolf and the panther, the old records are of particular significance today. However, these records are by no means as complete as one could wish, and mammals such as the moose and the wapiti which should, by every dictum of logic, have occurred in Connecticut, are nowhere reported to have done so. Students of our vanishing eastern wild life will find Mr. Goodwin's historical treatment of particular interest.

In discussing the present-day fauna, the author has followed a workmanlike presentation of data. He gives common and scientific names, a general description, and comments upon color and size, general geographical distribution, with a paragraph on the special distribution within Connecticut. This data is followed by an account of the life history of the species in question. Mr. Goodwin has drawn freely upon the life-history data recorded by other authors, but in the case of many species has added interesting comments based upon his own field observations.

The report is illustrated by sketches drawn by Francis B. Shields who has been quite successful in catching characteristic poses of his subjects.

It may be predicted for this report upon the mammals of Connecticut that it will prove to be not only interesting reading for the nature lover and a useful reference book for the student of the mammal fauna of Connecticut, but also a valuable contribution to the natural history survey of the State.—H. E. Anthony

A Child's Story of the Animal World. *By Edward G. Huey. Reynal and Hitchcock, New York. 335 pages. $3.50. (indexed).*

This is a fine book for children between the ages of eight and twelve. It should also be considered as compulsory reading for natural science instructors in grade schools, and for natural history museum workers who wish to discover new methods of approach to teaching problems wherein children are concerned. Mr. Huey, of the Calvert School of Baltimore, knows his subject not less but his audience more. To run through the systematic gamut of animal life from amoeba to gorilla in a single volume is certainly an ambitious project in itself. To present this same material for the enjoyment and enlightenment of children becomes a task that few have accomplished successfully. The author has succeeded so well that his handsome, large book at once becomes the answer to a long felt need.

The volume is in twelve carefully planned parts. The first, "tells what animals are made of, who belongs to the Animal Kingdom, and many surprising facts about some animals that look like plants." Part two relates entertainingly "about the animals with jointed legs, that zoölogists call Anthropods: also how to tell a spider from an insect and why the lobster is cousin to both."

The chapters go on to tell of the sequence from "oysters to octopus," "the age of reptiles," and all the way to part seven "which will make you sit up and take notice, with its stories of the queerest mammals—those that lay eggs and those that have pockets." The final part "discloses the mystery behind the facts (in this book) and tells why zoölogy opens the door to all kinds of fascinating things in the world about you." The chapter on evolution "How and Why" offers the best introduction to this subject for children that we have ever read.

An eleven-year-old boy visited our Bear Mountain Trailside Museum office a short time ago. He was to enter a hospital on the following day for an operation that would ultimately place his leg in a plaster cast for two months. Mr. Huey's work lay on my table, together with a number of other books. While the boy's mother talked with me, he at once began turning the pages of the *Animal World*. As he looked at the pictures and read here and there for a space of twenty minutes, his mother explained that she had brought the boy to our out-of-door museum to "keep his mind off himself" until the morrow, and also to secure advice as to how he might be diverted during the long weeks of pain and inaction that lay ahead.

"Could you suggest any books for him," she asked.

Without awaiting our answer, the boy, with eyes bright, asked "Couldn't I have this one, mother?"

In the last analysis the child himself will be the critic of books intended for his use. We could think of no better recommendation than a recital of the above incident. Perhaps if Mr. Huey reads this review, he will wish to send a copy of his book to the boy who liked it!

The greater number of the splendid illustrations are from both the American Museum of Natural History and the New York Zoological Society. This might indicate that the book has somewhat of a "museum plan" and so it has, justly and unavoidably. A book of this character must, of necessity, be planned as a zoölogical outline—a black and white representation of systematic natural history museum displays, if you will. This is decidedly in its favor.

William H. Hudson, who objected so strenuously to "stuffed specimens" admitted in *Birds and Man* that museum exhibits "might be made useful to young students of zoölogy." Mr. Hudson might have altered his expressed opinion that mounted animals are a "falsification and degradation of nature," if he could have seen a modern museum of today. The truth is that books of this sort and museum displays, too, are essential to any broad zoölogical study on the part of children. It would, of course, be an impossibility for a child to observe all of the creatures mentioned, in the field. The book thus serves the purpose of acquainting its youthful readers with all types of creatures to the end that he may become better equipped to appreciate the familiar wild life about his home and in his summer camp. The museum illustrations, especially of the lower animals, are indispensable. The numerous line drawings by H. R. Daugherty and Olive Earle are of distinct worth, too.

Simplicity of expression, clarity of ideas, and soundness of fact, combined with a straightforward, sane, man to man discussion, without a hint of "talking down," are all essentials that must be incorporated in any popular science reader that a child will take to his heart. This book fulfills all of the above qualifications and, in addition, has a personality of its own.—W. H. Carr

Parade of the Animal Kingdom. *By Robert Hegner. The Macmillan Company, New York. 675 pages, 743 illustrations. $5.00, (indexed).*

This large volume (it weighs five pounds), might well be a companion to *A Child's Story of the Animal World*, reviewed above. It is distinctly intended as a book for adults, yet the superb series of pictures would delight any child. Doctor Hegner's parade would require many hours to pass a given point and the entire procession would hold the onlooker's interest and close attention to the end.

The book is a revelation in concise, popular-scientific writing. Doctor Hegner, who is professor of protozoölogy in Johns Hopkins University, marshals his forces in orthodox fashion from protozoa to mammals. The chapter on the "First Animals" treats a subject, difficult to popularize adequately, with a keen appreciation of the general reader's viewpoint and with the highest regard for accuracy.

Life history studies are given for each type of animal. A careful explanation in each instance tells of habitat, enemies, food, locomotion, methods of self preservation and of reproduction. The subject balance is excellent. There is no trace of over-emphasis upon any one group of creatures.

Doctor Hegner writes with wit and charm. In describing a living place of the hedgehog hydroid, he remarks that "Only an overworked imagination could conceive of such a bizarre place to live as the top of a snail shell inhabited by a hermit crab." The description of the animal itself and the treatment accorded the coelentrates as a whole ranks high in the entire book.

In introducing this group, the author asks, "How would you like to be nothing but an animated stomach with perhaps a load of superfluous jelly to make you look stout and prosperous? If you think this would please you, we suggest that you study the group of animals we call Coelentrates, a word that means 'hollow intestine.' "

Did we say that this was a book for adults only? Change three words in the above paragraph and what child would not understand?

The chapter dealing with Amphibia begins in this way: "In many respects the Amphibia, such as Frogs and Salamanders, lead an enviable and carefree existence. The Greeks gave them the name Amphibia which means 'double life,' but this double life has nothing to condemn it, since it simply refers to the habit of spending part of the time on land and the rest of the time in the water. In fact, a sort of summer vacation on a river or lake or at the sea shore, delightfully extended throughout the year, with a swim whenever desired and sun baths galore."

Slight excursions into the realms of generalization and anthropomorphism should by no means discourage readers of encyclopædic books. Nevertheless, if a salamander in our northern country "desired" to swim and enjoy a sun bath in mid January, we fear it would be frequently disappointed! Forgive me, Doctor Hegner, but there it is!

This book should prove of the very first value in school, museum, and public libraries, as a ready reference for inquiring students of general zoölogy. Its scope is so all-embracing that it is impossible to convey any idea of its worth by merely quoting several paragraphs as above. Any naturalist or nature student would be glad to own this volume. We would also like to recommend this book to nature teachers and to nature trail builders.—W. H. Carr

THE SEA FOR SAM. *By W. Maxwell Reed and Wilfrid S. Bronson. Harcourt, Brace and Company, Inc., New York, 1935.*

This is the story of the seas from the days when the world was new. W. Maxwell Reed, writing with young readers in mind, describes first the formation of the earth, then the earth's capture of its satellite, the moon, so important a factor in the movement of the seas. The story of how the continents apparently float about over a fluid mass beneath the earth's shell and of how the continents are continually being raised and lowered, often a rather involved concept, is presented in a very clear and lucid manner not only for the young person to whom it is addressed but also for the more mature reader. The history of the seas, as told here, appears to favor the Wegener theory of the separation of the continents. That is to say, one great continent, Pangea, was present in the early days of the world and for hundreds of millions of years remained the sole land mass. Then during the Cretaceous it began to split up. The Western Hemisphere broke loose and the rift between Pangea and this new world became the Atlantic Ocean.

The discovery and exploration of the seas from the times of the Greeks to the circumnavigation of the globe by Magellan is discussed in an all too brief chapter. The theme returns to the more physical aspects of the sea with a description of the ocean bottom could we walk through its canyons, climb its mountains, and traverse its plains. Several extremely interesting chapters on the waves and tides follow.

At this point the story is taken up by Wilfrid S. Bronson, who has written and illustrated the portion of the book dealing with life in the seas. He writes of almost all of the main groups of invertebrated animals from the simple protozoa through the fishes to the sea-living mammals. Mr. Bronson has done an excellent job, for he not only describes the animals themselves with a rare freshness, but manages to impart something of the unsuspected turmoil of life beneath the waves.

Mr. Reed then tells of the Gulf Stream, other ocean currents, and the formation of icebergs, their size and their eventual breaking up. An interesting chapter, contributed by F. C. Brown, describes how, by means of tides, winds, ocean currents, evaporation and rain, the sea mixes the many organic and inorganic elements entering it.

The last portion of the book gives the reader a glimpse of how theories are made, disproven, and sometimes forgotten. An account of Charles B. Lipman's amazing discovery of living "germs" imbedded in coal fifty million years old and in specimens of rock meteors is accompanied by the admonition that acceptance of this as a definite fact must rely upon a preponderance of evidence in its favor and also upon a critical examination of the conditions surrounding its discovery. Could not these "germs" have entered the coal at a later time? By questions such as this Mr. Reed introduces the young reader to the scientific, objective frame of mind.

The collaborators have successfully tackled the staggering task of portraying the sea's physical aspects and its teeming life with no sacrifice of fact for fancy. The book is exceptionally well illustrated with photographs, Mr. Bronson's drawings of undersea life, which are especially effective, and diagrams borrowed from the literature of geology. A unique feature of the presentation, the constant challenge to the young reader to weigh statement and conjecture, to demand sufficient evidence before acceptance, and to consider hypothetical working bases as such and as no more, is a philosophy of which many adults are incapable much less a child of twelve.

It is unfortunate that the publishers have determined on the age-limits of twelve years and up. The story flows along very smoothly, but because of some of the ideas involved, must needs draw upon a vocabulary certainly several years above that of the twelve-year-old. For a sophomore or junior in high school, or in fact for any interested adult it is a fine book.—G. Miles Conrad

THE ALLIGATOR'S LIFE HISTORY. *By E. A. McIlhenny. 117 pp. 18 figs. Christopher Publishing House, Boston.*

The alligator, the largest American reptile, has been extensively studied by embryologists and anatomists; but its life history, its daily habits and contacts have remained largely conjectural. Strange though it may seem, much more was known of the social life of a Madagascar crocodile than of our own familiar 'gator. But now thanks to the careful studies of a naturalist born and raised in the heart of the Louisiana alligator country, this much needed information has been worked out and published in book form. Mr. E. A. McIlhenny has seen fit to present his studies in popular style. Probably few of his readers will realize how many original and important contributions to animal behavior are compressed within these few pages.

McIlhenny's book definitely establishes the fact that the mother alligator defends her nest, and takes care of her brood over one winter. There is some evidence that she even feeds them. Males have definite dens to which they return, often from great distances, year after year. The bellow of the male alligator, like the call of many male birds, is an advertisement that a particular territory is occupied. Females are not able to bellow, but they can give a guttural snarl—in reply to the male. The musk glands which have always been considered alluring devices are often emptied of their pungent odors during fights between males. Hence they may aid in defense as well as in attraction of the opposite sex.

Some of the most interesting sections of the book give a first-hand account of nest building, den digging, and methods of feeding. "Alligators seem to know the difference between poisonous snakes and non-poisonous snakes. When an alligator catches a cotton-mouth moccasin, which is a poisonous snake, as soon as the snake is grasped in its mouth it is shaken vigorously until quite dead. When a non-poisonous snake is caught, it is not shaken, but killed by being crushed between the jaws." It further seems that alligators must rise to the surface if they are to chew their food. Objects that can be swallowed whole are disposed of while submerged.

The alligator has the richest mental life by far of any American reptile. The rapid disappearance of this magnificent species from many parts of the South is greatly to be regretted. McIlhenny records an eighteen-foot specimen shot in 1879, and describes his difficulties in obtaining large specimens in recent times. He has shown how alligators rapidly increase when protected. It is to be hoped that the splendid little book McIlhenny has published will arouse a greater interest in the personal every-day life of America's largest saurian. It is only by such interest that one can hope to secure adequate protection.—G. K. N.

HANDBOOK OF THE HEAVENS. *Edited by Hubert J. Bernhard, Dorothy A. Bennett, and Hugh S. Rice. Whittlesey House, McGraw-Hill Book Co., New York. $1.00.*

PERHAPS the most difficult task for one who wishes to acquire a general knowledge of astronomy is the "breaking in." Text books seem rather pedantic and too full of information, and if the novice associates with those interested in the sciences, their superior acquaintance rather awes him. It is to initiate such novices that the *Handbook of the Heavens* has been prepared. While written under the auspices of the Junior Astronomy Club, it is not childish in form. Its general arrangement is that by which man originally learned the sciences. The first quarter of the book deals with the constellations, with charts for the seasons and detail maps for the different sections of the sky. Sufficient text accompanies these maps to describe the ancient groups and make them live for the observer.

The next quarter of the book treats of the Solar System, and discusses the earth's companions, the planets, and the moon. Then meteors and comets are given brief mention but sufficient to encourage one to hunt farther for more information. It is in this section the telescope appears. Man's knowledge of the Solar System grew by leaps and bounds after Galileo applied his glass to the sky. And that same vista opens here for the student. If he has a small instrument available he is encouraged to use it, but if not, the pictures in the book must satisfy him.

The latter half of the book deals with more telescopic objects, double and variable stars, nebulæ and clusters. Eclipses and asteroids are given a place. The chapters on the use of the telescope and photography will interest many.

In so short a book no subject can be adequately treated. It is not the intention to do so and the editors and authors would have misplaced their energy had they tried. So many books divulge the special interest of the writer by an over-emphasis on that subject at the cost of adequate space for something else. By collaboration this was avoided in the *Handbook of the Heavens.*

A glossary closes the book and for the benefit of the veriest beginner it might be enlarged to include many words innocently used in the body of the book but not sufficiently defined there. A valuable addition would be a recommended list of books for further reading, perhaps one good book on each of the subjects mentioned.

—WM. H. BARTON, JR.

THE CHINESE. THEIR HISTORY AND CULTURE. *By Kenneth Scott Latourette. 2nd ed. combining Vols. I and II in one book. The Macmillan Company, New York. $6.00.*

TO this reviewer, who lays no claims to a very profound knowledge of Chinese history and culture, this massive book by Professor Latourette is a welcome and handy guide into a field ordinarily omitted in the education of westerners. The plan and the content of the book is as simple as it is logical. After a brief geographical description of the area which was to be the scene of the Chinese drama, we are led into a discussion of the interrelationship of environment with the political and cultural characteristics of various sections of China. Then follows a section on the origin of Chinese civilization both from archæological and traditional evidence. With the preliminary spade work accomplished, the historical China emerges. Its successive dynasties and its political vicissitudes are examined succinctly and clearly. The second volume is confined to the treatment of the principal aspects of Chinese life under such heads as government, economic life and organization, religion, social life and organization, art, language, literature, and education.

The detail in Chinese history is so vast and the ramifications of its culture so complex that more than two volumes would be necessary to satisfy a specialist. Therefore, it is hardly just to quarrel with Professor Latourette for his omissions. But it seems to this reviewer that the sections on the various expressions of art and literature are rather perfunctory. The connections with the esthetic development of the west are largely neglected and the discussions of some of the art forms are too thin to be more than superficial. One has a feeling that they are mentioned for the sake of completeness and not for the light they shed on Chinese character and Chinese civilization.

The reader, however, cannot but be impressed by the vast range of Professor Latourette's scholarship, by the catholicity of his selection of authority, and by his pleasant style. It is a vivid picture that he limns of the most ancient civilization in the world with a continuously vital civilization. For the busy adult who is eager to acquire a familiarity with the gargantuan outlines of a fascinating country, this book is to be recommended.—H. L. S.

The Collared Lizard: A Laboratory Guide. *By D. Dwight Davis. New York, The Macmillan Company. 1934.*

This is a short concise guide to the dissection of the collared lizard. It is sufficiently detailed, however, to give the student a comprehensive view of reptilian anatomy. Too often in an undergraduate course of comparative vertebrate anatomy the reptiles are dismissed with one or two classroom lectures or at best a laboratory study of an atypical form such as the turtle. Thus it would seem that Mr. Davis's choice of the lizard is fortunate, for this form is one of the least specialized of the existing members of the class and it is also readily available.—G. Miles Conrad

Wellcome Photographic Exposure Calculator Handbook and Diary 1936. *Issued by Burroughs Wellcome & Co., $0.75.*

As in former years this little volume contains much condensed information concerning photography. Naturally the use of the products made by the company that issues the book is stressed, but this does not detract from the usefulness of the general statements. The blank pages for recording the conditions under which pictures are made should remind amateurs not to neglect this important step in developing their skill. The exposure calculator is about as perfect as one that does not actually measure the light can be made.

—F. E. Lutz

Primitives and the Supernatural. *By Levy-Bruhl, Lucien. E. P. Dutton and Co., New York, 1935. $5.00.*

For many years now, Professor Levy-Bruhl has devoted his amazing resourcefulness and energy to tracking down, in likely and unlikely places, in the accounts of missionaries, travelers, and ethnographers, odd and bizarre facts about the way in which the mind of primitive man works. This book is less oriented to one basic idea than have been his others; it is more a collection of odds and ends of strange ideas and practices, about which Professor Levy-Bruhl can express—as he has so often expressed before—his unfailing amazement that primitive man is not as logical as he thinks modern man is, or should be. The book should interest especially two types of readers, those who are wont to report, carelessly and gaily upon the customs of the natives whom they may chance to encounter in their wanderings, and those who like to meditate upon how logical we ourselves have become. The first class of reader, the explorer, the naturalist, the interested and note-taking traveler, will have an opportunity to see how strange an assortment can be made up out of chance observations such as he brings back to civilization. The second reader, he who thinks we are logical and scientific, has only to cudgel his brains a very little to find examples of equally pre-logical thinking among ourselves.

While the pages are filled with the vivid, bizarre, and arresting, they nevertheless are organized to no point which is new or revealing. Modern ethnological research deals not with Primitives or with "the Primitive," but with many and diverse primitive peoples, each with a view of life which contains its authenticities and its amazing contradictions—when seen from the outside. Professor Levy-Bruhl in his comments is essentially the cultivated Frenchman who believes that the substitution of the metric system for systems with an older history and more internal contradictions, means a genuine revolution in the way in which people think. He is content to wonder and to comment on the ways of those who know not the metric system and its analogues, and in so doing he fails to explore the rich and diverse possibilities for understanding, not the "primitive mind" but the human mind, which material on primitive peoples offers us.—Margaret Mead

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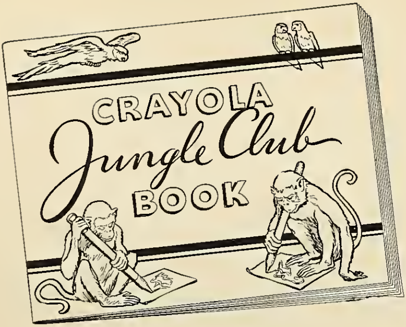
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Henry Fairfield Osborn

August 8, 1857—November 6, 1935

TRIBUTES PAID AT MEMORIAL MEETINGS IN NEW YORK CITY, NOVEMBER 7, NOVEMBER 12 AND DECEMBER 18, 1935

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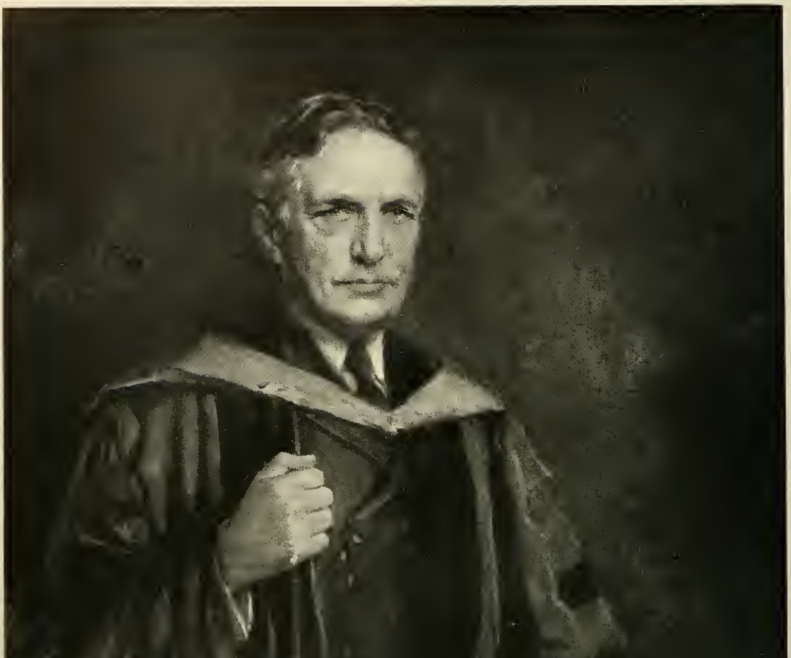

Henry Fairfield Osborn

From the portrait by Julian Lamar, painted in 1924, for the New York Zoological Society

WHEN I think of Professor Osborn it is always first as a devoted friend and a perfect companion. Perhaps no one, not even a member of his family, knew him in those respects better than I. Since 1923, during the intervals between expeditions, I have lived at his home. Every morning we breakfasted together; at night we talked in front of the fire; often in the days we took long walks through the woods at Castle Rock or in Central Park.

He knew even the most intimate episodes in my life. I brought to him all my problems and he made them his own. Out of the fullness of his wisdom and experience he gave me the advice that directed every phase of my life and work. As I see the last fifteen years in perspective I realize what I owe to him. He was truly a foster father.

As a companion he gave me more real happiness than I have known with any other man. He had the heart of a child and the freshness and gaiety of youth which made me feel that his years only equalled my own. To look at any landscape with him was to enjoy it more because of his great love of beauty. His keen sense of humor made it a delight to listen to a story with him or to live through any experience however simple. We could laugh together and talk together like two boys. There never seemed to be a difference in age between us.

His home life with Mrs. Osborn and his family was the most beautiful that I have ever known. One of the greatest privileges of my life was to have been admitted to that home and to have shared it almost as a son.

I have lost a dear friend and a loved companion. From the world has gone one of the last Great Gentlemen.

ROY CHAPMAN ANDREWS

Memorial Meeting of the Administrative and Scientific Staffs of the American Museum

PRESIDENT F. TRUBEE DAVISON presided at the meeting which was held November 7, 1935. He said:

We are met this afternoon on a very sad occasion. In moments of deep personal sorrow, words seem utterly inadequate, and that is particularly true when we attempt to express our feelings with regard to Professor Osborn.

Here at the Museum we knew him in a different way than did others. Some of our number worked with him for nearly half a century. Many others were his close associates over a period of many years. All of us were his devoted friends.

The world knew him as a great scientist, a leading educator, and a very distinguished American. We knew him in that way, too, but with a finer, more intimate understanding of him as a man. Ours has been the privilege of a daily contact which inevitably brought with it an appreciation of his human and spiritual powers.

You and I realize the perfect idealism which ruled his life. We have seen his determination to reach that ideal, led by an indomitable will and an unwavering faith, overcome difficulties which to us would have been insurmountable. We know better than others, that his abilities and capacity for leadership placed this Museum in the very front rank of scientific and educational institutions both at home and abroad. By his works he surely enriched the lives of millions of his fellowmen, whom he loved so much, and whom he served with such unswerving devotion.

Our very dear friend has passed on, but his influence will continue through the generations. He has—unconsciously to be sure, but none the less effectively—shown us how a great life can be lived, guided by a simple faith in God, and endowed with the rarest and finest of human qualities.

He has bequeathed to us and to those who follow us, a great trust. As the years pass by, may those connected with the Museum hold clearly before their eyes his picture—not only as a cherished memory, but as a challenge. If that be done and we can look into our own hearts and satisfy our own souls—each of us and by ourselves—then and then only can his successors and ours find real peace of mind and justify his confidence and his love.

DOCTOR SHERWOOD paid the following tribute to Professor Osborn:

Professor Osborn has left behind him a splendid record of service to the American Museum, covering a period of more than forty years. He was our president for a full quarter of a century, an epoch in the Museum's history which witnessed unprecedented development in all its branches—physical, financial, scientific, and educational. Under his leadership and direction the building space was more than doubled; the City's annual appropriation for maintenance increased from approximately $160,000 to the half million mark; the endowment, the backbone of the Museum's life, multiplied from $2,000,000 to more than $14,000,000; the Museum membership increased over 400 per cent; the scientific staff was more than trebled; the earth was dotted with our expeditions; collections of priceless value were brought within our walls; volumes of publications, scientific and popular, were issued and given world-wide distribution; the artistic standard and effectiveness of Museum exhibitions was vastly improved; while the popular presentation of natural history and kindred subjects was made so appealing that many technical scientific terms became household words.

Throughout President Osborn's administration it was my privilege and good fortune to stand at his elbow. In this long association, therefore, I had exceptional opportunity to observe, feel, and *know* his character and personality. Words of mine would be wholly inadequate to summarize his achievements or evaluate his contributions to human knowledge. Therefore I wish to speak merely of a few of his characteristics which were outstanding and have left on us a vivid impression of a great man.

Notable was his *breadth of vision.* While his special science was palæontology, it was the Museum as a whole that was of paramount importance, and every department had his genuine interest. Always was he keen for developments which would make our institution a greater power in science and education. For example, I well remember his enthusiasm when he first learned of the wonderful instrument called the Zeiss Planetarium. It was only a few weeks later that he dispatched Doctor Fisher to Germany to bring back first-hand information of it.

Next I have in mind his *tenacity of purpose.* Here was a man born to wealth who might have led a life of luxury and ease. Instead, he set out with the determination to make his mark in the field of science—and he did. This same tenacity of purpose he applied to the administration of the Museum. Obstacles did not deter him. They were there to be overcome and he forged ahead. When he was sure he was right, no one, not even his most intimate friends, could swerve him from what he felt was his path of duty.

Third I place his *fertility of mind*—and what fertility it was! He could think of enough things that ought and must be done to keep a regiment of us busy. Oftentimes I wished his mind weren't quite so fertile and that we might have time to catch up with his ideas or complete some of the problems on hand. Still it was this fertility of mind that kept us on our toes and urged us on to achievement.

Another outstanding characteristic was his *sympathy with youth.* He had an affectionate regard for all children and nothing gave him so much pleasure as to see the classes of school children streaming into the Museum. One of his great delights was to stop boys or girls and quiz them on what they thought of the Museum. Repeatedly I have heard him tell with great laughter of the little red-headed fellow he accosted in the elevator one day.

"Well, my boy," said Professor Osborn, "what do you like best in the Museum?"

The little tot, in sepulchral voice, answered, "Fossils."

I have always had my suspicion that the youngster knew to whom he was speaking.

Finally I mention the Professor's *eternal optimism.* He had a philosophy of life which carried him over discouragements that would have floored a less virile nature. Again and again I have seen him up against difficulties that were simply overwhelming, and invariably he would come up with a smile on his face. And so I feel that if he were here today he would not want us to consider this a time for sorrow or sadness at the loss of a dear friend, but rather would wish us to reflect on the achievements of his administration and do our best to carry on his ideals.

DOCTOR GREGORY then gave an outline of Professor Osborn's life:

Our beloved former president, Henry Fairfield Osborn, died suddenly of heart failure at his home at Garrison-on-Hudson, N. Y. on Wednesday, November 6, 1935, at the age of seventy-eight. It is exceedingly difficult to express adequately our sorrow in losing this steadfast friend and great leader. His human contacts were so numerous and so uniformly helpful to others that a great many people will deeply mourn for him. In fact his good deeds on every side were so manifold that we know not where to begin. Nevertheless we must attempt a brief outline of his life:

He was born on August 8, 1857, at Fairfield, Connecticut, the son of William Henry Osborn and Virginia Reed (Sturges) Osborn. His ancestry on both sides was of the best and his very able and devoted parents left nothing to be desired in the influences that moulded his childhood. While he was still quite young his father built first "Wing and Wing," and later (1881) "Castle Rock," at Garrison, N. Y., overlooking the Hudson River, opposite West Point. In this delightful home and environment the young Fairfield early showed his interest in natural history. As a student at Princeton he came under the influence of the famous Doctor McCosh and was so much attracted by the subject of philosophy that he undertook several studies in psychology and philosophy which were published as brief papers at intervals from 1880 to 1884.

Meantime, however, through Professor Guyot of Princeton, he became interested in palæontology and in 1877 he, together with his friends W. B. Scott (who was destined to remain as his life-long colleague) and Francis Spier, Jr., organized and carried to a very successful conclusion the Princeton scientific expedition of 1877; this expedition explored the Bridger Basin in Wyoming and brought back many important specimens of new and little known Eocene mammals. From 1878 to 1880 he worked as a graduate student and (1881-1890) instructor at Princeton. In those days evolution was the burning topic of interest in all universities and before palæontology had supplied the direct evidences of evolution, embryology and comparative anatomy were looked to as its principal supports. Osborn at that time, as later, saw that all three sources of evidence should be studied together.

In 1879-80 therefore he went to England for advanced graduate work at Cambridge University with the great embryologist Balfour. Later he went to the University of London, where he became the pupil of T. H. Huxley and ardently studied comparative anatomy under that inspiring teacher. We see in his early study on the foetal membranes of the opossum and other marsupials signs of his ability to choose subjects of strategic importance. The same is true of his studies on the origin of the corpus callosum of the mammalian brain; in his rather extended paper on the principal fibre tracts of the brains of amphibians he opened up a line of investigation which has been carried on by, among others, Professor C. J. Herrick, who gladly acknowledges the importance of Osborn's pioneer studies. In fact, between 1883 and 1887 comparative neurology may be said to have been his principal subject and with the assistance of Dr. Oliver S. Strong he planned to write a general work on comparative neurology.

Gradually, however, his papers in vertebrate palæontology became more numerous and after another extended residence in England he completed his memoir on Mesozoic Mammals (1888), which again demonstrated his ability to choose a subject of major importance and to extract from it far-reaching results. For it was the Mesozoic Mammals that carried back the history of the mammalian molar teeth to a very distant date, when the triangular or so-called tritubercular molar crown was in its initial stages. He therefore endorsed Professor Cope's theory of the origin of the tritubercular molar, adding many original evidences and observations of his own and early developing an ingenious system of naming the principal cusps of the upper and lower molars, which system has since been adopted by the palæontologists of the world. While giving every due credit to Cope, he proceeded to apply his own nomenclature in detail to the complex molar patterns of ungulates and showed how, with this tritubercular key, as he called it, one could unlock and open up the most complicated molar patterns, analyzing their parts and reading the history of the group.

In 1891, through the coöperation of President Seth Low of Columbia University and of President Jesup of this Museum, Professor Osborn was invited to take up his residence in New York and to become, on the one hand, Da Costa professor of zoölogy at Columbia University and on the other, founder and curator of the department of vertebrate palæontology in the Museum. About the same time and chiefly through his efforts the Museum acquired the private collection of fossil vertebrates which had been amassed by his friend Prof. E. D. Cope of Philadelphia; this served as the nucleus of the new department of vertebrate palæontology. He soon gathered around him an able staff: Doctor Wortman as assistant curator, Mr. Adam Hermann as chief preparator, and others. Then under his vigorous and efficient direction was begun that great series of field explorations for fossil vertebrates which has never ceased to this day. To make a very long story short, the building up of the department of vertebrate palæontology through forty-five years of his continuous activities is regarded by some as his greatest single achievement.

He derived great inspiration and enjoyment from his numerous palæontological field trips, especially in the western states but also in Egypt and Mongolia and in his trip around the world.

At the time of his death he was the author of some 940 articles, papers, books, monographs, etc., listed in his bibliography. It is obviously impossible to refer in detail to this astonishing output; but it seems very safe to state that among his most important contributions to science were the following:

1) His initial studies on the origin of the corpus callosum of the mammalian brain;

2) His memoir on the Mesozoic Mammals;

3) His numerous contributions to the study of the evolution of mammalian molar teeth to and beyond the tritubercular type;

4) His many important papers and monographs on the fossil rhinoceroses, titanotheres, horses and proboscideans;

5) His great textbook on "The Age of Mammals."

With regard to the theory of evolution, his outstanding principles, or laws, as he called them, include the following:

1) The law of *continental and local adaptive radiation;*

2) The law of *homoplasy* or parallel but independent evolution in related lines of descent;

3) The law of *tetraplasy*, whereby evolution results not from the operation of single causes, but as the resultant of forces from four principal directions (external environment, internal environment, heredity, selection).

4) The law of *alloiometry*, or adaptive modification of dimensions of the skull, feet or other parts, arising independently in different lines of descent.

5) The law of *rectigradation*, or *aristogenesis;* i.e., the gradual appearance during long ages of new structural units of adaptive value, predetermined in the germ plasm and in their initial stages independent of natural selection;

6) The law of *polyphyly;* i.e., the normal occurrence of many related lines of descent, derived eventually from a common stock, but coexisting throughout great periods of time.

In 1899 Professor Osborn became closely associated with President Jesup in the administration of the Museum and upon the death of Mr. Jesup in 1908 he was elected president of the Board of Trustees. From that day until his retirement to the position of Honorary President in 1933, he carried a vast burden upon his strong shoulders. During this period, and thanks in large part to his able leadership, many buildings were added in response to ever-growing pressure of collections and exhibits. Undoubtedly not even he could have accomplished all this if he had not budgeted his time so effectively and concentrated so intently upon one thing at a time.

On the personal side, Professor Osborn was sincere, benign, urbane, without guile, very loyal in friendship and highly appreciative of loyalty in others, extremely helpful, especially to his students and assistants. He consistently respected the right of his colleagues and assistants to differ with him in the interpretation of scientific problems.

He loved young people and delighted in furthering their education along broad and thorough lines. His wife, Lucretia Perry Osborn, until her death in 1930, was at all times a most able and enthusiastic partner. His children and grandchildren survive to cherish his memory.

THE following resolution was then presented at the close of the meeting by DOCTOR CHAPMAN:

Resolved, That we, fellow-workers of Henry Fairfield Osborn in The American Museum of Natural History, express our sorrow in the death of an associate who had been with us for forty-four years, and pay our tribute to his memory as scientist and administrator.

As an investigator he held a place of first rank: of explorers in the field, among workers in the laboratory, and as a student of the writings of others.

As a teacher he was an inspiration in the classroom and lecture hall and through the written word.

As a curator he introduced methods of exhibition which, in their power to attract attention and convey information, have made the halls under his control models of museum technique.

As a President under whose administration our Museum has attained a leading place among the museums of the world, he was never influenced by the expediency of the present but advocated only those standards which would meet the tests of all time.

As a man of the highest ideals, exceptional culture, and wide outlook, he ever saw the results of his own researches in their relation to civilization, and regarded the museum as an educational force of supreme importance in acquainting mankind with the nature of his environment.

The resolution was adopted by a rising vote of all those present.

Special Memorial Meeting of the Board of Trustees of the American Museum, November 12, 1935

Mr. Davison, presiding, called upon Mr. Madison Grant, who presented the following resolution, which was unanimously adopted:

Resolved, That the Trustees of The American Museum of Natural History desire to record their profound sorrow at the loss sustained through the death of their colleague

Henry Fairfield Osborn

who passed away on November 6, 1935, and also wish to express their appreciation of his outstanding and invaluable services to the Museum, to science, and to the world.

As president for a full quarter of a century, Professor Osborn was our leader, guide, and inspiration, in shaping policies and providing for the development of the Museum. He carried into his office all of his finest qualities of character—unquenchable optimism, strong determination, constructive ability, appreciation, and a broad conception of the relation of science to human affairs. His administration witnessed unprecedented development in all branches of the Museum—physical, financial, scientific, and educational.

As a man of science, his contributions even surpass his notable administrative achievements. He was the sponsor and father of the department of vertebrate palæontology, which is now without a peer. And, while this science was his greatest specialty, he had an astounding grasp of the Museum as a whole and strove with dynamic energy, foresight, and judgment to make it preëminent.

He had a facile pen, and his writings are of such scope, variety, and magnitude that they are in themselves monumental. He stands as a great popularizer of natural history. At the same time he had a full realization that the foundation of popular science is pure science, and he never swerved from his determination that the Museum should be as renowned for its scientific researches and explorations as for its popular exhibits and educational work. This devotion to his scientific ideals permeates all his work as curator, as teacher, as author, and as administrator.

The Museum was foremost in his thoughts, and his world-wide travels, his studies of all the great museums, his personal presence at scientific conventions and meetings of learned societies brought increased honor and prestige to this institution.

As a citizen the world owes him a debt of deep gratitude. He was patriotic, deeply interested in problems of human welfare, a zealous advocate of broad cultural foundations, and generous of his time and thought in supporting conservation movements. He had a deep spiritual nature, was a devout churchman, and an outstanding champion of the thesis that there is no real conflict between science and religion, between the laws of nature and the laws of God.

Generations to come, as well as his contemporaries, will honor him for all time as an eminent scientist, an inspiring teacher, and a virile personality.

Memorial Service at St. Bartholomew's Church, New York December 18, 1935

This service was arranged by a group of Professor Osborn's associates and friends "in thankfulness for his long and splendid life, in appreciation of his services to the community and the nation, in commemoration of his high ideals and accomplishments in education, science, citizenship, and in love and affection for him as a man."

The service, which was held at 4:30 P. M., was conducted by Dr. George Paull Sargent, rector of St. Bartholomew's Church, and Dr. E. Clowes Chorley, rector of St. Philip's Church, Garrison, N. Y. The sponsors were:

Charles P. Berkey
Nicholas Murray Butler
John A. Campbell
E. Clowes Chorley
Edwin Grant Conklin
John W. Davis
F. Trubee Davison
John H. Finley
Virginia C. Gildersleeve
Madison Grant
William K. Gregory
George E. Hale
Robert Andrews Millikan
J. P. Morgan
Charles W. McClure
Mabel Rice Percy
George Paull T. Sargent
William B. Scott
Samuel Sloan
Alfred E. Smith
Vilhjalmur Stefansson

Among the musical selections by the organist and choir were the "Prelude to Parsifal" and anthems by Gounod and Bach.

The memorial addresses were as follows:

"Youth and Education"

DR. H. W. DODDS, president of Princeton University, Princeton, New Jersey, said:

One hot day in the spring of 1876 three eager undergraduates were stretched out on a canal bank trying to master Paley's *Natural Theology*. Evidently they were meeting with but moderate success in their struggle with this great work; for in one of those periods of reverie in which imagination seems to roam more freely than in periods of willed concentration, the thought occurred to one of the three, "Let's go West and collect fossils."

It was before the day of field trips or geological laboratories, and Wyoming, which was to be their destination, was still Indian country. But the young men were spirited, courageous, and inquiring, and the spontaneous suggestion was shortly to ripen into actuality. One year later, having earned their baccalaureate degrees, and equipped with camp paraphernalia to fill a baggage car and prepared to fight Indians as well as collect fossils, the three classmates, together with two others who had joined with them, set forth in the interest of the Princeton Museum. Meeting with marked success as collectors, they were able to bring back to their college the first vertebrate fossils to adorn its halls.

A moving spirit in this unusual enterprise was Henry Fairfield Osborn. In the light of his great contribution later to the development of the American Museum of Natural History, it is fair to say that the American Museum as we know it today springs from the experience of this early expedition which confirmed young Osborn's intention to devote his life to science.

A second college experience reveals further the nature of Professor Osborn's mind and the stuff of which his character was made. Returning the following year for graduate study in company with his classmate and companion on the Wyoming exploration, Prof. William Berryman Scott, he began the serious study of science. The two wanted to know more about vertebrates but the college had few facilities for the study of the subject. Accordingly the young men set up a dissecting room in an unused basement, and despite the objections of a professor who told them that they did not know enough to branch out for themselves, they began to teach themselves anatomy.

I feel that this experience, in which youthful curiosity and purpose prevailed against the indifference and discouragement of the professor, helps to account for two distinguished phases of Professor Osborn's personality, his abiding respect and affection for youth and his dissatisfaction with existing methods of education which he later criticized so severely and which he worked so hard to improve.

I do not believe that I ever began a conversation with him on any subject which did not eventually turn to a discussion of young people and methods of education. The restlessness which characterizes the younger generation today, its impatience before the authority of accepted ideas, never seemed to trouble him. His confidence in youth was constant. His fears were rather for the parents and teachers.

Two of the finest attributes of youth are the inquiring spirit and the desire to be creative. It was a peculiarity of Professor Osborn that in later life, when most of us prefer to find a little niche of our own and stop there in comfort, he never lost these two youthful qualities. He always wanted to know more about the "how" of things and he always wanted to create things. Witness how often the word "creative" appears and reappears in his writings.

This attitude led him to grave dissatisfaction with the methods and content of the college curriculum which prevailed during the first half of his life.

Professor Osborn's youthful outlook forced him to a positive theory of education which I think can best be summarized by a brief account of the direction which colleges and universities have pursued during the past twenty-five years. The chief elements of the current trend, as I view it, are as follows:

First, a recognition of the profound differences in people, physically, socially, and intellectually. "Every man," Professor Osborn has written, "is born to do one thing better than any other; the earlier he discovers it, the better it may be for his intellectual salvation."

We no longer require a fixed curriculum for everyone, on the ground that certain subjects are necessarily good for all. In place of a fixed table d'hote colleges now seek to arrange a suitable harmony between subjects studied and the special capacities and predilections of the student. In short, instead of treating the student as one of a mass, the principle of individualization is applied, both as to sectors of knowledge to be studied and methods of instruction. Here biology and psychology support the findings of general educational experience in respect to the wide individual variations among human individuals.

But, in the second place, this freedom from a universal regimen does not mean that the student roams at will through the curriculum, in the mistaken idea that a superficial smattering of many subjects constitutes a liberal education. The young man now selects a field of limited concentration in which he acquires throughout his college years some small grasp of one sphere of knowledge which in a certain sense he can make his own, and upon which the creative play of his mind can operate independently. The aim is to encourage thought rather than imitation and spongelike absorption. The knowledge gained may be of practical use in later life; more probably it will establish intellectual, non-vocational interests of great value, but in any case it has given the student a taste of the joy of the chase in the field of ideas and some training in its technique.

Another reason for the encouragement of independent work by the student in a field of concentration is the increased interest which such work arouses and the sense of value which it brings. We contradict the saying of the old schoolmaster who asserted that it makes no difference what a boy studies as long as he doesn't like it. We recognize the emotional drive which interest brings; we believe that this drive is necessary to all good work in college, as in later life. "One of the first objects of a curriculum," wrote Professor Osborn, "should be to fasten the interest of the student at some point for some subject, and use this as a lever to lead him to take a more serious view of other subjects."

The newer methods of instruction and study call not only for teachers of sound training and experience, but also for appropriate and adequate facilities. We are far removed from that time when a student was regarded as scholastically equipped if he read one book in a course or when the demonstration of an experiment in physics or chemistry by the professor in charge of a class was considered all the laboratory work necessary.

And finally, education if it be true to itself must stand for freedom and against indoctrination. This cannot be repeated too frequently in a day when teachers are being urged to organize themselves into a pressure group to work "boldly and without ceasing" for a new social order. Teachers are deliberately to reach for power and then to make the most of it in building a new social order, despite the fact that social scientists have not been able to agree upon a diagnosis for the ills of the present one. Thank heaven, most teachers are too honest to thirst for political or economic power, but let those who do, remember that here is the death of academic freedom. A teacher-propagandist is only a paid hand.

Professor Osborn had his enthusiasms and his strong beliefs, but he also exalted the spirit of free inquiry.

The golden age of Greece was marked by the two qualities of youth which I have been describing, curiosity about God and the world, and the urge to create. There is a tradition that when Solon visited Egypt the priests of that country were struck by the active character of his mind. "You Greeks," said one of them, "are always children; there is not an old man among you. You are all young in your souls." Professor Osborn would have been at home in that immortal company.

What more can education accomplish than to show men how they can always remain young in their souls?

"*Creative Science*"

Doctor James R. Angell, president of Yale University, New Haven, Connecticut, gave the following address:

To deal adequately with the subject assigned to me in this memorial service would require a man of scientific stature at least equal to that of Henry Fairfield Osborn. Obviously I can make no pretense to such qualification and I may only hope haltingly and imperfectly to recall some of the great achievements of our friend as a creative, intellectual force.

There is to be stressed in the most emphatic manner the extraordinary training which he gave himself as a very young man, a training which was to bear rich fruit in his later years in that it brought him a breadth of outlook on his problems which few scientific men have ever enjoyed.

He began with youthful enthusiasm as a junior in college the study of geology under Guyot, and was at about the same time brought under the stimulating teaching of President McCosh of Princeton in the fields of philosophy and psychology. In his senior year he suddenly discovered the thrilling problems of biology. Upon his graduation he was allowed to take part in a field trip in the Far West which brought him face to face with the fascinating challenge of palæontology. Shortly thereafter, having gone abroad, he was introduced to the study of comparative anatomy, embryology, and neurology, and then became actively interested in the studies Sir Francis Galton was conducting in the psychological field of mental imagery. These important steps in his progress were the results of contact with great scientists like Huxley, Galton, Balfour, and later Welch. He came to know at first hand much of anthropology, and so when he returned once more to focus his attention upon geology and especially vertebrate palæontology, it was with a broad background of biology which enriched and steadied his whole outlook on the profound problems of cosmic, and particularly organic, evolution that were to dominate so much of his later career.

He himself repeatedly emphasized the importance of combining breadth of knowledge and interest with intensive specialization, if on the one hand science were to avoid a narrow and unimaginative submergence in the mere accumulation of fact and on the other were to escape a shallow and superficial veneer of pseudo-knowledge. His own career was a superb embodiment of his convictions in this respect.

I doubt if any useful purpose would be served, even were I wholly competent to undertake it, by a recital of the specific contributions which he made either to a factual knowledge of the various scientific fields which at one time or another he cultivated, or to the more general theories which he formulated and defended. The former task would result in a mere catalogue, the latter would take us into the arena of controversy, for he dealt with large and vital issues which are still far from permanent solution. Nor did he fear to stand alone in such conflicts, for he confidently asserted his conviction that time would sift the true from the false and he was quite ready to abide that judgment.

The honors which were showered upon him by universities and learned societies the world around testify to the high estimate that his scientific peers put upon his work, which in bulk, as well as in quality, has rarely been matched. His listed bibliography of books, monographs, and lesser articles runs to 940 entries.

While it is impossible to attempt any summary of his scientific contributions, one may at least mention the monumental works on the history and evolution of the horse, the titanotheres, those giant monsters of prehistoric time, and the proboscideans—the latter, which would in point of magnitude have out-stripped his other great works, unfortunately was not quite completed before his death. His text book on the Age of Mammals, like his work on Stone Age Man, is accepted as a standard and definitive exposition.

He inevitably became deeply interested in the problems of evolution, to which he brought a breadth of scientific knowledge altogether rare. For his great predecessors—Buffon, Lamarck, Darwin, Wallace, and others—he naturally entertained the deepest respect; but he could accept neither Lamarck's conception of the transmission of acquired characteristics, nor Darwin's natural selection among chance variations. He formulated as a substitute his theory of rectigradation, or aristogenesis, by which he meant to teach the gradual appearance through the ages of new structures, or units, of adaptive value, predetermined in the germ plasm and in their initial stages at least independent of natural selection.

For fifty years a teacher, much of the time conducting typical college and university classes, his dogmatic insistence upon the supreme value of the creative element in education and science was exemplified in his entire method of instruction. He insisted that his students should think critically and constructively upon every point, and encouraged them constantly to seek for new discoveries, however trifling, to formulate and test new hypotheses, to cherish genuine intellectual independence. He went so far in this direction himself as to take pride in consulting preceding authorities in a field where he planned to work only after he had made exhaustive explorations and reached his own conclusions.

However wise this procedure may be as a general rule, Professor Osborn has hardly any creative achievement to his credit more important than the profound and enduring stimulation of an astonishing number of young scholars whose enthusiasm for fundamental research and the career of creative scientist was kindled by the spark of his own contagious devotion to the conquest of the unknown. These men are now distinguished leaders in their fields, occupying commanding positions all over the world.

In the life and work of Henry Fairfield Osborn we have the picture of a man of tireless energy, of profound learning, of wide scientific vision, keen and fertile imagination, activated by a deep religious faith and by sensitive humanitarian impulses, who served his time as few have done and who has through the work of his powerful mind left behind him an enduring monument to the benefit of all humanity. We his friends will always bear him in proud and grateful memory.

"Science and Religion"

Dr. Henry Sloane Coffin, president of the Union Theological Seminary, New York, N. Y., gave the closing address:

In the midst of a controversy some thirteen years ago, Professor Osborn declared: "I am myself, or endeavor to be, a consistent evolutionist; I also undertake the far more difficult task of being a consistent Christian."

Born in a devout and earnest home, where his mother devoted herself to the religious upbringing of her children and spoke of this boy as "the child of many prayers," Professor Osborn at Princeton had come under the influence of President McCosh, who, unlike many of his generation, taught that the views of Darwin were not incompatible with Christian theology, and that evolution seemed to be the method which God had followed in creating His world. That in 1876 started Professor Osborn on his scientific career with no sense of an irreconcilable conflict between his outlook as a scientist and his faith and duty as a follower of Christ.

And he was not only a loyal Christian, but also willing to assume office in the Church and he was outspoken as a man of religion. Writing, for example, for the *American Hebrew*, he said:

With scientific discovery as one of the great aims of human existence, it is commonly believed that the pursuit of science is a career and aim in itself, and that the man of science may disregard the old standards of morals, of conventions, and of religion, and may press into new fields of conquest untrammelled by all the moral forces and traditions of the past. No greater mistake than this could be made. A purely mechanical conception of science, devoid of the sense of beauty and without the broad humanitarian principles that regulate and govern human life and conduct, will not either advance civilization or promote the spiritual and moral welfare of mankind.

In his opinion religion and science were the two factors which would control the future of the race, and they ought to unite and work together, for either divorced from the other—unscientific religion or irreligious science—was perilous.

So he advocated restoring the teaching of religion to our public schools. It grieved him that children were getting their moral ideals and their views of life from the "movies" and the headlines of newspapers, rather than from the Bible. He wished the Ten Commandments, the Lord's prayer, the Sermon on the Mount, and the choice spiritual utterances of the prophets and St. Paul made part of the education of every boy and girl.

And he was convinced that the scientific study of Nature makes more compelling the precepts of goodness which the great moralists teach. "Nature," he said, "never relaxes but always reinforces moral and spiritual laws."

His concern for the health of the race made him a vigorous advocate of temperance. He wrote with sad seriousness:

> "Every drinking man I knew in college in 1876 and every drinking student of mine up to the year 1890 has paid the death penalty, and they were all fine men who could hardly be spared."

A lifelong communicant and church-goer, with so pronounced Christian convictions and so plainly a teacher of righteousness, Professor Osborn was suddenly startled to find himself classed publicly by Mr. William Jennings Bryan with Voltaire, Thomas Paine, and Robert Ingersoll, as a subversive atheist; and to have this challenge posted outside one of our large churches:

> IS THE AMERICAN MUSEUM OF NATURAL HISTORY MISSPENDING THE TAXPAYERS' MONEY AND POISONING THE MINDS OF SCHOOL CHILDREN WITH FALSE AND BESTIAL THEORIES OF EVOLUTION? SHOULD NOT THE BIBLE BE DISPLAYED IN THE MUSEUM AS WELL AS OLD MUSTY BONES?

The minister of this church, in a debate with the present speaker before the Authors' Club, drew a lurid picture of the obscenities in some of the shows then being produced, and of the immorality current in the city, and asked: "Who is responsible for this lewdness and this animalism?" and answered his own rhetorical question: "Henry Fairfield Osborn."

The attack upon the Museum, and especially the onslaught upon the teaching of science in schools by the Tennessee Legislature which eventuated in the trial of Mr. Scopes, roused Professor Osborn. In newspaper articles, pamphlets, and books he undertook to enlighten the ignorance which had prompted these assaults, and to show the true meaning of current biology and palæontology for morals and religion. With a happy title, suggested by the Book of Job, he wrote *The Earth Speaks to Bryan.*

> Today the earth speaks with resonance and clearness and every ear in every civilized country of the world is attuned to its wonderful message of the creative evolution of man, except the ear of William Jennings Bryan; he alone remains stone-deaf, he alone by his own resounding voice drowns the eternal speech of nature.

He set forth the evidence, painstakingly gathered by many investigators, for the long process by which mammals had been developed in millions of years through fishes and reptiles, and added:

> This is not perhaps the way Bryan would have made the animals, but this is the way God made them!

He was not unsympathetic with Mr. Bryan's main concern:

> We both believe in the Bible and in its supreme value in moral and religious instruction; we both believe in Christianity and in the principles of conduct set forth in the Sermon on the Mount; we both believe that in the future of our country we must retain the faith of our fathers in the providence of God.

But addressing directly the eloquent Commoner he insisted:

> Every breath you draw, every accelerated beat of your heart in the emotional periods of your oratory depend upon highly elaborated physical and chemical reactions and mechanisms which nature has been building up through a million centuries. If one of these mechanisms, which you

> owe entirely to your animal ancestry, were to be stopped for a single instant, you would fall lifeless on the stage. Not only this, but some of your highest ideals of human fellowship and comradeship were not created in a moment, but represent the work of ages.

Repeatedly he pointed out how gross was the misrepresentation that evolutionists taught that man had been developed from a monkey.

> No existing form of anthropoid ape is even remotely related to the stock which has given rise to man.

In various books Professor Osborn gave the results of the discoveries of the past century and a half in the evolution of man, tracing our race back some two million years. He spoke with enthusiasm of the high attainment in intelligence and artistic power of the cave dwellers. He was convinced that they could compete on equal terms with the sculptors and artists of today, and could (so far as their brains were concerned) enter any branch of contemporary intellectual life. His admiration for them made him indignant at the popular notions of the caveman.

"I am perhaps more proud," he wrote, "of having helped to redeem the character of the cave-man than of any other single achievement of mine in the field of anthropology."

To Professor Osborn evolution was "a continuous creation of life fitted to a continuously changing world."

He had watched the materialistic theories, common in his younger years, fall into the discard. He was profoundly disgusted with much current psychology, which seemed to him to have lost both the soul and the mind of man. He wrote an interesting study of the career of the naturalist, John Burroughs, under another of his happy titles: *The Racial Soul of John Burroughs,* in which he declared that far more important than the development of man's anatomy is the development of his spiritual nature. He welcomed the phrase of the British philosopher, Lloyd Morgan, "emergent evolution," which made place for God's continuing creative activity in the process, culminating in the soul of man, and promising its further growth and ultimate supremacy. He read and rejoiced in the works of religious thinkers, past and present, and felt that "in the hunting-field of human thought, the scientists have taken as many falls as the theologians; the honors are even in this regard."

He was fond of summing up the meaning of evolution for the higher life of man in the following statement which occurs again and again in his published writings:

> The moral principle inherent in evolution is that nothing can be gained in this world without an effort; the ethical principle inherent in evolution is that only the best has the right to survive; the spiritual principle in evolution is the evidence of beauty, of order, and of design in the daily myriad of miracles to which we owe our existence.

When a few weeks ago death's finger lightly touched him, and he slept, the career on earth was closed of one who as finely as any man in his time combined the trained and industrious scientist and the Christian gentleman and ardent public servant of faith and righteousness. Throughout a conspicuously useful and interesting life he was held and upheld by a simple earnest loyalty to Jesus Christ. As a naturalist he worshiped God, of whose glory heaven and earth were to him full, and to whom he found lines of Wordsworth a fit utterance of his own adoration:

> Wisdom and Spirit of the Universe!
> Thou Soul, that art the Eternity of thought
> And givest to forms and images a breath
> And everlasting motion!

HENRY FAIRFIELD OSBORN

How peacefully he sleeps!
Yet may his ever-questing spirit, freed at length
  from all the frettings of this little world,
Wander at will among the uncharted stars.
Fairfield his name. Perchance celestial fields
  disclosing long sought secrets of the past
Spread 'neath his enraptured gaze
And beasts and men that to his earthly sight
  were merely bits of stone shall live again to
  gladden those eager eyes.
So let us picture him—enthusiast—scientist—
  friend—
Seeker of truth and light through all eternity!*

CHARLES R. KNIGHT

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* First printed in the New York *Sun*, November 13, 1935

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Seal of His Highness, the Dalai Lama — *Cover*

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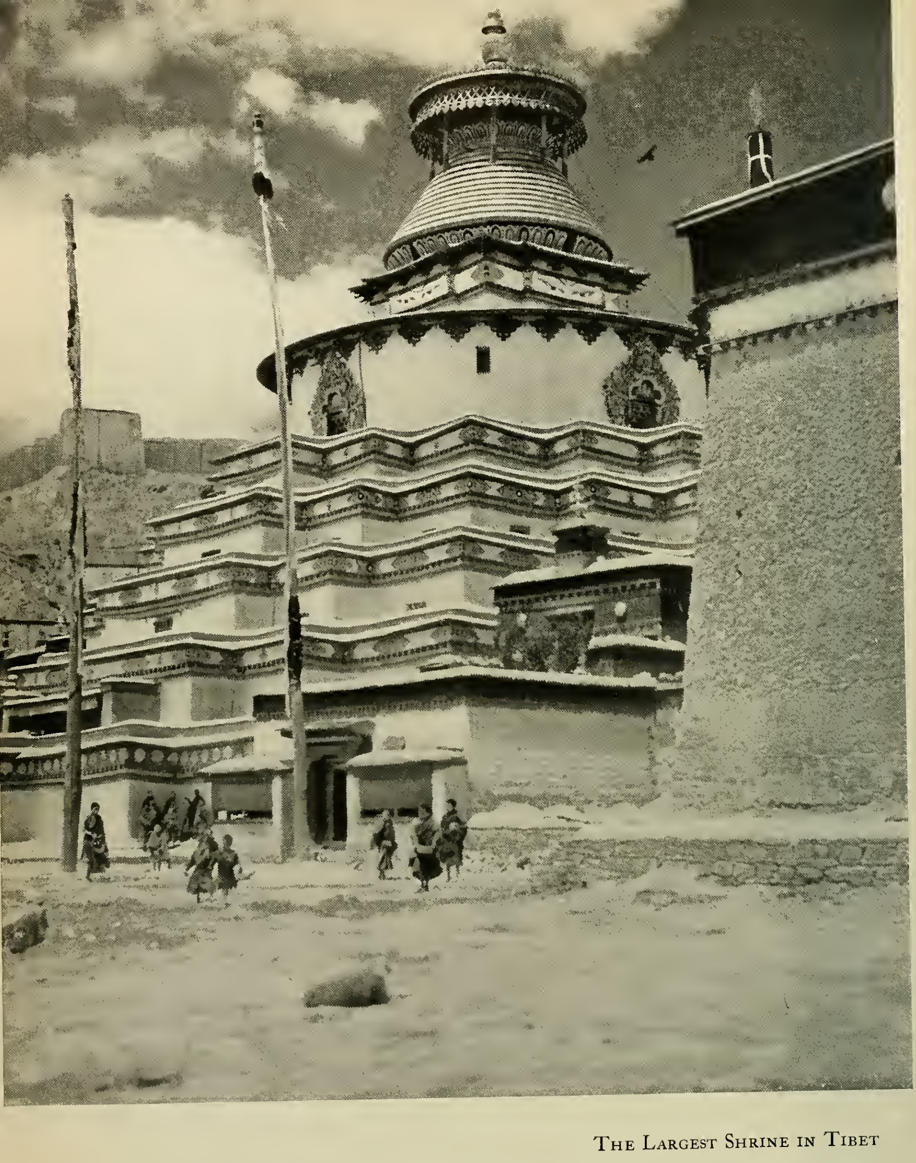


THE LARGEST SHRINE IN TIBET

Embellished with gold leaf, the roof of this striking structure gleams brightly in the rarefied air of over 13,000 feet. Gyantse, where it is located, is the third largest city in Tibet and was an early halting place on the journey which took Suydam Cutting and Arthur Vernay to the mysterious city of Lhasa, the abode of the supreme ruler of Tibet

Mr. Cutting tells here the story of his unique negotiations with the Dalai Lama, incarnation of Buddha, master of the Potala palace-monastery and supreme ruler of Tibet; and of his subsequent visit to the forbidden city. He took the first motion pictures of Lhasa; and the photographs reproduced here from his extensive collection, are the most extraordinary ever shown of this mysterious city.

In Lhasa—The Forbidden

An extraordinary trip to a city which few explorers have reached, where the palace-monastery of the Dalai Lama stands supreme

By C. Suydam Cutting
Trustee, American Museum of Natural History

The explorer who tries to visit Lhasa is confronted by a political and religious bulwark that is well-nigh impossible to penetrate. Tibet is a closed country to all foreigners, and Lhasa, the abode of the Dalai Lama, is guarded probably more closely than any other city in the world.

The first definite progress that the writer made toward gaining entrance to Lhasa was in 1928. In that year application was made by the Roosevelts through the Government of India for a permit to cross the southeastern corner of Tibet en route to the Chinese province of west Szechwan.

His Highness the Dalai Lama

The proposed expedition, in company with Theodore and Kermit Roosevelt, had no immediate bearing on Lhasa, but it was the beginning of negotiations with the Dalai Lama. One must begin there in a small way. Lieut. Col. F. M. Bailey, the political officer at the frontier who handled the request, thought there was no chance of gaining entrance even to this corner of Tibet, but some months after the original communication had gone up to Lhasa, an affirmative answer was received.

The ensuing expedition never actually utilized the permit, for an alternative route to the destination was followed. But the significance of this contact in view of subsequent events, was enormous. It was the opening wedge.

Strengthening relations

That winter we journeyed in high country along the Tibetan border of China, a region inhabited by the Tibetans, Lolo, and Nashi. Then in 1930 followed a trip to Gyantse. Foreigners are permitted by treaty in limited numbers to visit this city, about a hundred miles beyond the Tibetan border. But a solemn promise over one's signature states that one will not travel beyond the immediate vicinity of the city. Here was another opportunity to press negotiations, and it was not lost. A letter in Tibetan requesting permission for further travel was dispatched accompanied by the conventional scarf to the Dalai Lama. Also many presents were distributed.

The two head men at Phari at the border were given decorative Hammacher Schlemmer aluminum ware, and the Governor at Gyantse received a cuckoo clock. Each of the five members of the Kashag, or High Council at Lhasa, was sent a self-winding wrist watch. The Dalai Lama's presents naturally had to be chosen with especial care. A gold self-winding wrist watch was only the beginning of his gifts.

He was a man of fifty-seven, shrewd in the ways of statecraft. But on the gentler side, it was known that he loved animals enormously. He had always wanted Lieut. Col. Bailey, the frontier officer, to send him, of all things, an ostrich. He must have seen a picture of one. But as Lieut. Col. Bailey tried to explain to him, it would have been impossible for an ostrich to survive the rigors of travel to the Tibetan plateau. Hoping to provide something equally amusing, I sent the Dalai Lama a pair of dachshunds. A week went by and then a telegram came from him which showed that some interest was being taken in the animals. He asked what their names were.

A week later, however, came his answer to our petition. Permission to visit Lhasa was denied; but, great luck, the caravan could cross the nomad country on its way back and visit the city of Khampa Dzong. The letter stated that there was general disapproval of strangers traveling into the interior of Tibet; but he and the Kashag gave permission and hoped I would have a pleasant journey.

The British had shown great consideration by allowing me, with the local Tibetan Governor's permission, to wander anywhere I wished in the great Gyantse Valley, which was ordinarily forbidden country. The proper Tibetan permits were made out, and every Tibetan was kindness itself, including the Governor of Khampa Dzong, who invited me to stay at his house and was the deserving recipient of my last remaining cuckoo clock.

I was closer to Lhasa than ever before. Friendly relations had definitely been started.

Letters from the Dalai Lama

In the following years a number of letters came from the Dalai Lama. The Tibetan script, on native paper, was always accompanied by a typewritten translation, done by the Dalai Lama's secretary. Both are contained in an intricate envelope addressed in both Tibetan and English, and sealed with the official seal. Our correspondence had much to do with the affairs of Tibet. I was asked to see if wool merchants in the United States would buy Tibetan wool via Calcutta. In response to this, several merchants were induced to write to Pangda Tshang of Upper Bengal and Lhasa, who has the monopoly in this product, which is used in the manufacture of carpets. These negotiations have not progressed as favorably as they might, however, and the matter is still one of my considerations.

An autographed portrait of Hoover

Letters were also entrusted to me to be delivered to the State Department of the United States. The Dalai Lama wished to establish good will, although for diplomatic reasons there could be no direct communications between the governments. The letters were duly answered and sent back by me with an autographed photograph of President Hoover. Finally I was even asked to induce the United States Congress to buy silver and send it to Tibet in bond. This was an attempt to avoid the India export tax, and was quite hopeless for several reasons, but it gave me an excellent chance to send a letter bearing the letterhead of Congress.

When negotiating with orientals, anything that enhances one's importance never fails to benefit one. For this reason I always made it a point to write to the Dalai Lama every time I could use imposing stationery. The Dalai Lama knew that the Viceroy of India strongly backed my purpose to visit Lhasa, but the mere fact of my knowing him counted, too. So I was careful to write to Lhasa on the household note paper of the Viceroy, also on that of the Commander-in-chief, whom fortunately I also knew—never on hotel paper.

All this time presents were going back and forth. I sent the Dalai Lama a long glass cocktail shaker which, though it would not serve him in the ordinary manner, would be useful in mixing his buttered tea; also illustrated books on American architecture, a chair with a folding canopy, silver plated polar bears on agate, an ornamental glass bowl, and some fine woolen blankets. The dachshunds, as well as a pair of Dalmatians which I sent later, are still alive, but they have never produced puppies.

The Dalai Lama sent me Tibetan *Apso* dogs in three lots, which unlike my gift, are breeding successfully.

The Dalai Lama continued to write regularly. Whenever I came to India I was to advise him of the fact, and so forth.

Then in December, 1933, he died. The cable from his personal assistant reached me on Christmas day, notifying me of the "temporary passing away" of the incarnation of Buddha. (His successor must come from among the children born on the night he died and is selected by the priests by omens. But to date, his successor has not been discovered.)

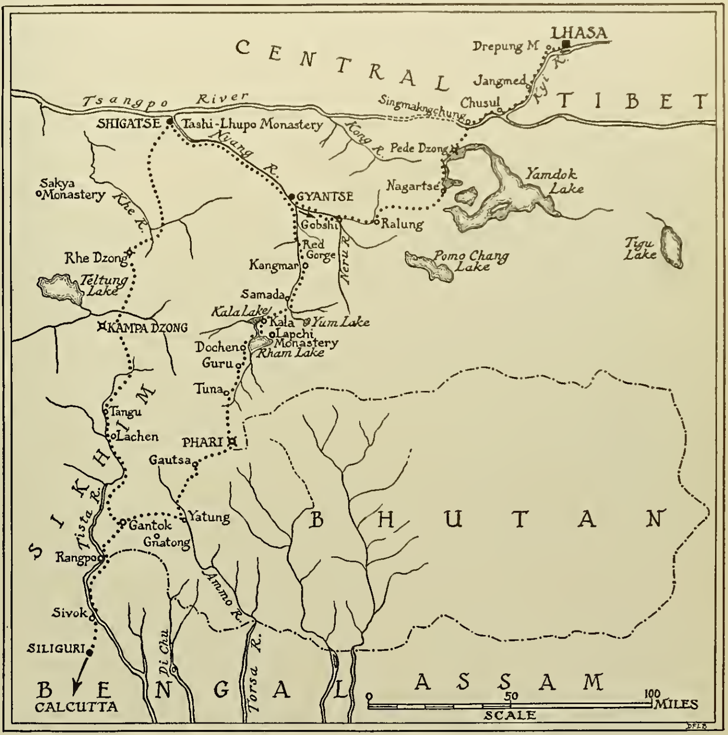
"Knowing your constant correspondence with late Holiness," the cable read, "hope to receive assurance of continuance of your friendship at this unfortunate conjuncture."

So following the sad death of one who had become a real friend, correspondence continued with the Kashag, or High Council.

Later in 1934 with permission from Lhasa there was a plan to go to Southeastern Tibet with the Roosevelts and to cross a big section of the plateau; and it was hoped that this might be the time for Lhasa. But because this expedition was to be chiefly for the purpose of collecting animals, and since shooting is counter to Buddhist law, we dropped the project.

Therefore, when Mr. Vernay and I planned the expedition described in this article, anthropological and botanical collections were the object of it, not hunting.

Negotiations this time went smoothly. My name was by now well known in high circles


CENTRAL TIBET
LHASA
Drepung M
Jangmed
Chusul
Singmakngchung
Tsangpo River
SHIGATSE
Tashi-Lhupo Monastery
Nyang R.
Kongo R.
Pede Dzong
Yamdok Lake
Nagartse
Sakya Monastery
Rhe R.
GYANTSE
Gobshi
Ralung
Red Gorge
Neru R.
Kangmar
Pomo Chang Lake
Tigu Lake
Rhe Dzong
Teltung Lake
Samada
Kala Lake
Kala
Yum Lake
Lapchi Monastery
Rham Lake
KAMPA DZONG
Docheno
Guru
Tuna
Tangu
Lachen
PHARI
Gautsa
SIKKIM
Tista R.
Yatung
Gantok
Gnatong
Rangpo
BHUTAN
Ammo R.
Sivok
Di Chu
SILIGURI
Torsa R.
CALCUTTA
BENGAL
ASSAM
0
50
100
MILES
SCALE

ROUTE OF THE EXPEDITION TO LHASA

The dotted line indicates the route taken. Lofty passes separate Central Tibet, where Shigatse and Lhasa are located, from India. The Tibetan Plateau is intersected by mountains and habitable valleys. Up to 14,000 feet agriculture produces peas, barley, and hay; above that to 16,000 feet nomads roam with their sheep, yaks, and goats in Lhasa, I had always kept my promises with the government, and had endeavored to help the Dalai Lama in various ways. Permission to visit Shigatse only was granted, but we hoped that once we had reached this sacred city we might be allowed to proceed to Lhasa. And we started out from England early last July with great expectations.

Our first objective, Shigatse, is second only to Lhasa in size and political importance. It is the official residence of the Tashi Lama (Panchen Rimpochi) who is the spiritual head of the Buddhist world. Political reasons several years ago, during the life of the late Dalai Lama, caused the Tashi Lama to leave Tibet and take up his residence in China, where he still resides. At the present time there is a good deal of active talk as to his return to Shigatse in the summer of 1936, but the matter is shrouded in political intrigue which cannot now be discussed.

To reach Shigatse, which lies at an altitude of 12,800 feet, one follows either of two routes from India: one via Gyantse and the other via Khampa Dzong. The distance by the latter route is shorter, being 183 miles from northern Sikkim as against 236, but it is also by far the higher, crossing one pass that is over 17,000 feet. We chose the former route.

The passport which allows strangers to enter the interior of Tibet is a document written in Tibetan and bearing the Kashag's seal. Presentation of this document along the specified route of travel always brings immediate recognition. We actually carried two letters, however—one the regular passport, and the other in the form of a red pennant, which they call an "arrow letter." This letter proved of infinite convenience to us, and its use merits explanation.

A courier

When traveling in Tibet, it is the custom to change pack animals as often as required, and so to apportion this business amongst the various villages. Distances are consequently divided according to where the changes occur, and, since we nearly always made double marches, the routine was to change animals twice a day. Here is where the "arrow letter" became so valuable, for it traveled ahead of us by one or two days. Its presentation notified villagers and gave them ample time to collect their animals, which might be miles distant, tucked away in some valley where there was good pasturage.

Anyone who travels in the interior of Tibet will invariably be struck sooner or later with the realization that the country has never changed. Countries sometimes are so backward that they appear still to be existing in the seventeenth century or thereabouts. But with Tibet, the period could easily be a thousand years or more ago, and for this situation there are definite reasons.

A closed country

Consider the term "Forbidden Land," which is so often applied to Tibet. Along its southern border lie Nepal, an independent Hindu kingdom of Mongolian stock, and two native states of India, Sikkim and Bhutan, both of Tibetan stock. Natives of these three are allowed into Tibet, and do some trading with the inhabitants; but Tibet's racial intercourse ends here. Indians from India and those other races who live along the far-flung frontiers of Tibet may not enter, nor are any permanent resident government representatives allowed. Prompted largely by religious motives, the nation, an ecclesiastical one much dominated by Buddhist priests, will not tolerate foreigners or foreign customs and products.

In view of this and of the fact that the country is practically self-supporting, with a plethora of everything needed in daily life, it is not hard to understand why Tibet has not changed and why no one in the country particularly wants it to.

The social order is a complete feudal system such as existed in Europe during the tenth century. How truly fascinating it is to travel there, to live in the houses of the natives, to rub shoulders with them, eat Tibetan food in company, and to know all the time that the culture and manners are a changeless relic of a forgotten era. Add to this that the people of all ranks are charming and virile, that they possess a fine sense of humor and are ultra polite, and that they live in strong, well-built houses amply comfortable, and you can understand that exploring in Tibet can be most interesting and delightful.

One is at first somewhat surprised at the peculiar salutation received everywhere from the common people. Any peasant upon approaching a foreigner or nobleman sticks out his tongue and holds it out for a second or two. This is the polite gesture of greeting.

The Tibetan plateau is a country of very different altitudes. Shigatse and Lhasa lie in Central Tibet, where although the land is not as high as in the regions to the north and south the altitude is nevertheless extreme. The plateau is intersected by hills and mountains, graced here and there with high snow-capped peaks. It is a land of habitable valleys that range from gorges to vast plains. The higher the altitude the less fertile the land and more rigorous the climate.

Agriculture, which produces largely peas, barley, and hay, becomes scanty at over 14,000 feet. Here crop raisers begin to merge with the nomads, who roam with their herds of sheep, yaks, and goats up to 16,000 feet.

Anywhere on the plateau the climate is naturally a cold one, and even if people from south of the Himalayas were permitted to settle in Tibet, the altitude and cold would make their environment absolutely unsuited to their welfare and health. The winters, except to those inured to them for generations, are unbearable. During this season the higher one goes the more one is subjected to icy southeast winds which, blowing a full gale during the daylight hours, raise fearsome clouds of dust often mixed with snow that go hurtling over the great grasslands.

Traveling conditions

Summer is the proper time to visit this country, but the summer is short. At 14,000 feet early July is still coldish with possible snow flurries, and August is the period of rain everywhere. Usually during this latter month the mornings are clear, but cloud banks from the western mountain tops soon cover the valleys and by one o'clock a sweeping cold rain has arrived, often accompanied by hail.

The Central area is part of the watershed of the mighty Tsang Po River (Brahmaputra). This river is fed by innumerable tributaries that rise from upland springs and snows. All during August the many rushing streams are muddy from the masses of silt the rain has washed down from the mountain-sides. From the middle of September on through October the weather at 12,000 feet is perfect with a brilliant warm sun all day every day, yet with frost at night. This is the fine weather period, yet by mid-October at 14,000 feet the autumn is well under way and the cold winds are in full sway.

From this it is easy to understand that Tibetans must be a hardy race, particularly as there is little fuel in this bare country.

A splendid reception

Shigatse is situated in a huge, lovely valley surrounded by mountains. Our approach, late one afternoon, followed the river Nyang Chu, which three miles north of the city debouches into the Tsang Po. The first landmark one sees, arriving from any direction, is the great lamasery of Tashi Lhunpo, situated near the base of a mountain slope about a mile from the city. Its many gilded temple roofs completely dominate the landscape. Thirty-five hundred lamas reside here.

Word of our arrival had been sent ahead, and a splendid reception had been prepared. Guides met us at the outskirts, and the crowds which milled about our caravan as we passed through the narrow streets of the poorer section made our progress seem like a triumphal entry. We passed on to what might be classed as the more well-to-do residential quarter, and stopped at a house which was lent to us by the nephew of the Tashi Lama. There a small reception group awaited us. Buttered tea, the staple of Tibet appeared, and we were introduced to two gentlemen who were to act as permanent ADC's during our sojourn.

One wing of the house, situated in a lovely park, had been made ready to receive us and was hung with draperies and banners; also there was additional space for servants and kitchen. While on trail and stopping at different native houses, our permits required us to pay for rent and all other accessories we might want, which the natives were required to supply us at current rates. Here in Shigatse, however, the house was a gift of the Government and everything was made as comfortable as possible in true Tibetan fashion.

Next morning, as definite etiquette required, we started to make our round of calls on the high officials. These comprised three: the Governor in Tashi Lhunpo (a very high Lama, indeed the ranking authority of the district), a second very high Lama, and lastly the Dzong Pen or Civil Governor, who lived in the Dzong or city fort.

The high lama's residence was at the top of a tall massive building, and was reached by climbing a series of great wooden ladders (stairs are practically unknown in Tibet). He occupied two floors, which were divided into sitting rooms, verandas shaded by awnings, sleeping quarters, and a shrine corresponding to a private chapel.

We sat down to buttered tea and native sweetmeats, such as one would have at any social call in Tibet. The conversation, as always, was begun with platitudes and politeness—"Do you feel tired after your long journey? Were you treated well on the way? Is your house comfortable?" etc. etc. Conversation was much facilitated by a native woman of Shigatse who once had been an ayah in both Calcutta and Darjeeling and could do excellent English-Tibetan translation. She remained with us during the stay of ten days. The Governor promised for us a special review of 500 city troops of the regular army on the morrow; and with the usual polite salutations we took our leave and passed on to other calls.

First the Lama, then the Dzong Pen. These calls were similar and plenty of buttered tea was served at both. Living quarters of these officials, in sharp contrast to the massive grim exterior of the building they were in, were quite attractive. We had presents for each, which according to custom were presented to a servant on first entering and then no further attention whatsoever was paid to them. Tibetan scarfs had, of course, been properly exchanged.

Outdoor parties

Except, now, for the return calls, of which there were only two, for the High Lama pleaded his age as the excuse for not visiting us, the stricter formalities were over and we came to the lesser formalities such as lunch parties; these were truly delightful affairs. The weather, which had been very rainy, had just cleared up and the gentry of the city had decided, as is customary throughout Tibet during the fine weather, to hold such parties in the fine parks under their big summer tents. Three of these parties were held—one in the park of each of the Tashi Lama's summer palaces and one in our own park.

The tents are pitched in the shade of specially planted poplars (trees do not grow naturally as the plateau is above the tree-line); then from noon onward one or more days are spent there. A field kitchen is set up in a small adjoining tent where a mid-day meal is prepared. Recreation takes the form either of chatting or, what is very common, competition in archery, a sport for which there is real enthusiasm. The arrow, a curious one with a blunt perforated head that causes it to whistle as it passes through the air, is shot at a target from a range of about fifty yards.

Soldiers and priests

Two interesting shows were put on. The first was the military parade in the city's parade ground. There is little point in discussing the details of this affair other than to say that the troops did not seem all to have been chosen from the better physical elements of the population. The band, it might be said, which with leopard skins was somewhat modeled after native British units, played far better than the marching of the men, in their ill-fitting uniforms, merited. The parade was followed by a buttered tea party at the Colonel's house.

The other show, which was of great interest indeed, was a concentration in full regalia, maroon cloaks and yellow hats, of all the 3500 Lamas of Tashi Lhunpo. They congregated *en masse* in a great court of the lamasery which was dominated on one end by a raised dais on which stood the now empty seat or throne of the absent Tashi Lama. They remained in this court half an hour milling around and chatting together, amused and unperturbed by the moving picture camera, for the use of which the Abbot had given his permission.

Our real objective here as elsewhere was the acquisition of a botanical and anthropological collection for the Kew Gardens of England and the American Museum of Natural History respectively. As soon as the populace learned of the latter interest, masses of people congregated outside our house with many articles of ethnological value to sell. All the things which the Tibetans use in their daily life and the objects used ceremonially in the temples were offered for sale. This was exactly what we wanted.

As for plants we had to go slightly farther afield, as the near surroundings of the city were intensely cultivated and the land immediately beyond was quite barren of any flora. A trip to the Tsang Po valley, however, was excitingly successful, and a few days collecting proved highly gratifying.

A last word for Shigatse. Most of the streets are broad and clean and there is no congestion of population. It is true that it teems with beggars, most of whom are blind, yet what Tibetan city does not? It is as hospitable a city as one could wish for.

It is the custom of the Tibetans to return presents, and this is what we received: 8 sheep, 19 sacks of barley flour, 15 dozen eggs (very few edible), 20 pounds of black Chinese brick tea, 2 trays of vermicelli, 10 goose eggs, 3 sacks of clarified yak butter (in yak skins with hair on) of 12 pounds each, 2 pieces of jade.

On to Lhasa

During our stay in Shigatse numerous references were of course made to Lhasa. While it was not to be denied that Shigatse was a fine city, even its own citizens admitted enthusiastically that Lhasa was the queen of the land. It was naturally with intense excitement that we turned our caravan in that direction.

Our new permit which was necessary to visit this city was received, and read as follows:

"All Dzongpens and Headmen between Gyantse and Lhasa and along the road are all hereby ordered to bear in mind with permission of the Lamas and high officials of the kingdom: American Sahib Cutting and party have started from Gyantse. This passport is granted to the effect that you shall supply on payment without any objection or delay six riding ponies and 15 pack ponies. They should also be supplied, whether it is an intervening stage or a halting place, with fuel for kitchen, birdfruit (eggs), milk, etc., on payment according to prevailing custom.

"Given under the seal of the Tibetan Trade Agent."

We gauged our departure so as to reach Lhasa on an auspicious day, for because it is a holy city to do otherwise might interfere with the welfare not only of the city but of the entire nation. There are good dates and especially good dates, and we consulted the Tibetan almanac to select the best that was feasible.

Beyond Gyantse the plateau shortly rises to over 14,000 feet. Then after crossing two high passes the trail drops way down to the Tsang Po at 11,000 feet. Following this river downstream and up the Kyi Chu, one traverses country of a fairly low altitude. This section is populated, very fertile for agriculture, and all most beautiful indeed.

Practically the only export from the region we traversed is wool, which, however, goes to India in large quantities. From this the natives buy their imports, which are very limited indeed. Of metals they use copper, brass, and iron, which are transported on animals' backs. They use also some silver, but practically no gold.

The portion of the plateau over which we traveled is woefully lacking in mineral resources. The late Messrs. Hayden and Cossom recently made a survey, at the request of the late Dalai Lama through the Government of India, over some of the region that we traversed and quite an area of the high country north of Lhasa. But the late Mr. Hayden, who was a trained geologist, could not report the presence of any mineral deposits of any value. Incidentally, he was guaranteed by the government of Tibet a fair payment in rupees in return for his services, but refused the sum, claiming he had been paid many times over by the great interest of his trip.

Mineral resources elsewhere

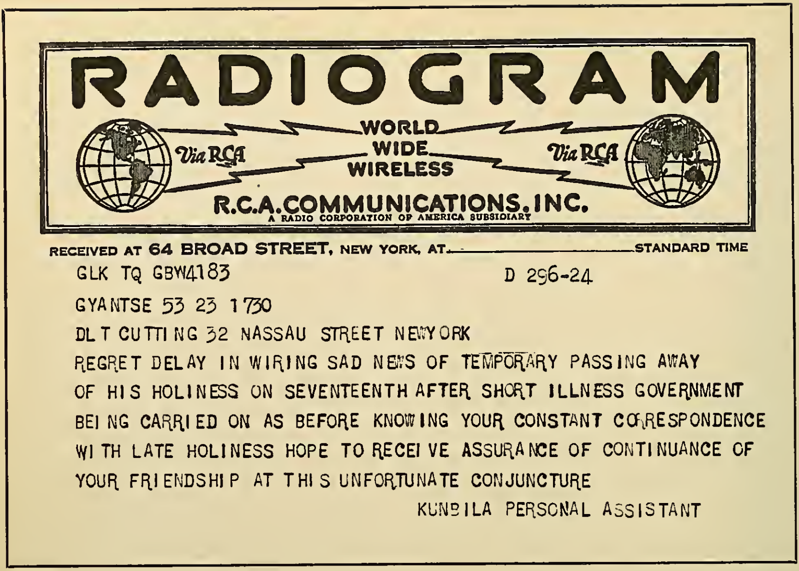
East of Lhasa is the area the Tibetans call Kam. Here the plateau gently falls as one proceeds eastward toward China and Assam, but in a northeasterly direction the country rises. Little is known of these parts of the plateau, but one can safely assume, since one so very rarely sees the presence of gold in Lhasa even among the rich and since so much metal comes from India, that this country is also lacking in minerals.

A similar condition would seem to exist in far eastern Tibet, the section belonging chiefly to China although containing small independent kingdoms such as Muli and Lolo. The author made a trip through a large part of this country and although a general statement would not be warranted, it can be said that there was very little evidence of mineral wealth, though hardly the dearth of the plateau. Gold, concerning the existence of which in Tibet there has recently been some speculation, did not seem to exist at all.

After being on the trail some days we drew near Lhasa. After the bleak, higher levels, the many areas of emerald green grassland, although swampy, were a lovely sight. Finally a bend in the long valley brought into view the great Potala, seven miles away.

A magnificent spectacle

It was indeed an awe-inspiring sight. Just as Shigatse is dominated by the lamasery of



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Via RCA WORLD WIDE WIRELESS Via RCA

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GLK TQ GBW4183 D 296-24
GYANTSE 53 23 1730
DLT CUTTING 32 NASSAU STREET NEWYORK
REGRET DELAY IN WIRING SAD NEWS OF TEMPORARY PASSING AWAY
OF HIS HOLINESS ON SEVENTEENTH AFTER SHORT ILLNESS GOVERNMENT
BEING CARRIED ON AS BEFORE KNOWING YOUR CONSTANT CORRESPONDENCE
WITH LATE HOLINESS HOPE TO RECEIVE ASSURANCE OF CONTINUANCE OF
YOUR FRIENDSHIP AT THIS UNFORTUNATE CONJUNCTURE
KUNBILA PERSONAL ASSISTANT

Tashi Lhunpo, so Lhasa is by the Potala; but of the two the latter is by far the more beautiful. It is indeed devastating to behold; and the spectacle increases in beauty as one approaches. Towering above the city, supreme now and forever, it is possibly the most magnificent building in the world, including the Taj Mahal. Although it has general shape only, with no balance of its component parts, it seems to wear better and better on intimate scrutiny. The most effective point from which to view it is probably the stone causeway which is lined with trees and water. What a building, and by full moon! Its architecture, purely Tibetan, reminds one definitely of no other style. It was begun perhaps in the tenth century, but renovations in the early seventeenth century developed it into what it is today. It could make one dream of ancient Persepolis, for perhaps this is what Darius might have lived in. There is room for much delightful speculation.

Guides had been waiting for us well outside the city, and as guests of the government we were escorted in. The way led past the Potala along a broad street with fine private buildings on the left and a vast open meadow on the right everywhere planted with clumps of willow. In the heart of the city where the bazaar is located, the streets, most of which are broad, are clean for an eastern city and do not seem nearly as massed with population as in either India or China. The buildings are well constructed, roomy, and with pleasant exteriors.

There is no glass made in Tibet and its transportation by caravan for windows is well-nigh impossible. Laden animals and humans pass here and there, (there is not one wheeled vehicle in the entire country) covered temporary stalls of temporary bazaars line certain streets, with the better permanent shops in the basements of buildings. Nowhere do bad smells, filth, or flies exist—so different are Tibetan cities from the general run of the eastern ones.

Our quarters were located in a perfect spot about two miles from the bazaar and adjoining Norpa Linga, the summer palace and regular residence of the late Dalai Lama. We occupied a small house with stable adjoining set in a huge walled garden of poplars and willows, such as have been planted all about the city.

The population of Lhasa is supposed to be about 40,000 but no census has ever been taken. Of these inhabitants about 16,000 are celebrate lamas who live in great lamaseries of which the two largest are Drepung (meaning a heap of poured rice) with 7500 lamas and

Sera (meaning a heap of hail) somewhat smaller. The inhabitants of Tibet are priest ridden and, in matters of politics and especially the choosing of a new Dalai Lama, the influence of these great lamaseries particularly Drepung, is very strong.

The government of Lhasa is made up as follows: There is a council called the Kashag made up of five—four lay nobles and one Lama, all of middle age or older. This council is a very powerful unit and, constituting the active governing body, it meets once a day. Above these in rank are: the Prime Minister, Si Lon Yapshi Lon Dun, and the Regent, Re-ting Po gya tsap Rimpoche, a reincarnate Lama chosen by the late Dalai Lama before his death. These latter two men, about thirty-five and twenty-five years old respectively, have the highest authority, the latter being able to demote at will any member of the Kashag from his high rank.

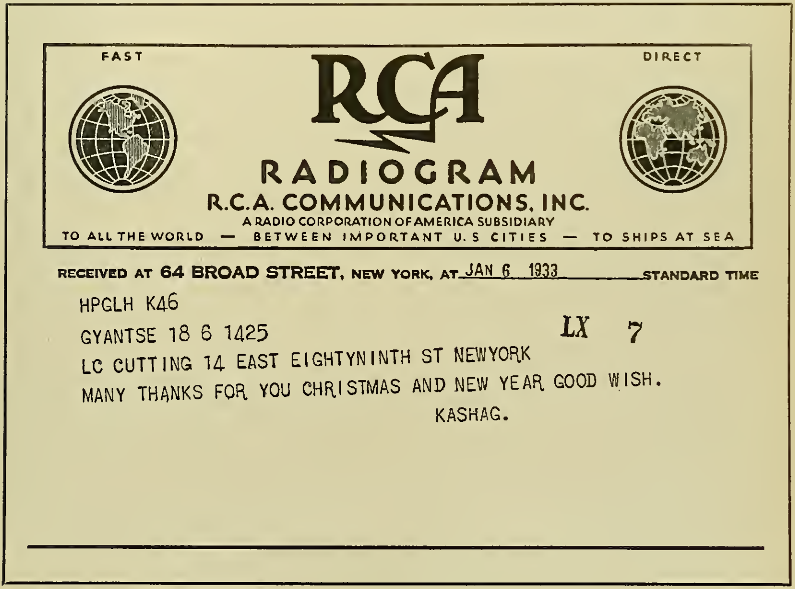
The title denoting membership in the Kashag is Shapé. At the time of our arrival the Regent and the senior member of the Kashag, Trimon Shapé, were absent searching for clews that could lead to finding a Rimpoche baby who might prove to be the reincarnation of the late Dalai Lama. Calling on the remaining officials took up the entire next day. These all, living in the city, had large houses that were usually anything but pretentious from their exteriors but really attractive and comfortable within.

The height of formality

During these visits had come real formality. The scarfs offered here had to be of the very best quality, brand new and both folded and presented in one special way. The presents to each had been sent to Lhasa several weeks before and, of course, were never alluded to.

Beyond our quarters to the westward extended Norpa Linga, the park of the late Dalai Lama, and three summer palaces. These are situated in a huge walled enclosure planted with poplar.

The Potala is the traditional winter palace of the Dalai Lama. But the late Dalai Lama chose to live in three renovated summer palaces exclusively save for one or two weeks in the year. Broad arbored walks that would be beautiful in any estate in the world criss-cross the park. The residences, surrounded with flower



FAST

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A RADIO CORPORATION OF AMERICA SUBSIDIARY

TO ALL THE WORLD — BETWEEN IMPORTANT U. S CITIES — TO SHIPS AT SEA

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GYANTSE 18 6 1425 LX 7

LC CUTTING 14 EAST EIGHTYNINTH ST NEWYORK

MANY THANKS FOR YOU CHRISTMAS AND NEW YEAR GOOD WISH.

KASHAG.

beds and wholly of Tibetan architecture, give one a strange feeling of something perhaps more European than anything one has seen elsewhere in Tibet. Exterior and interior of both, like the grounds, are immaculately clean. There are electric lights (hydro-electric), a Dodge and two Austin cars (the latter brought up in parts)—all entirely disused. There are also large stables and, in one far corner, barracks that housed what was called a regiment of infantry.

No one lives in these houses now except one high lama and at times a sort of major domo of the place who is a noble in gold dress. Both of these were in attendance when we went and entertained us with a most delicious lunch under one of the white awnings.

The rooms in the houses are lavishly decorated with beautiful wall paintings, banners, and fine wood carvings. The furniture is mixed; there is some silk upholstered European furniture of a rather stiffish type, also Tibetan couches along the walls which are used for both sitting and lying on.

On the way out we passed a small artificial pond with a gilded summer house near by where in hottish weather His Holiness (the late Dalai Lama) used to sit and watch his ducks disporting.

Tibetan cuisine

Several lunch parties were held which we attended (Tibetans do not have guests to the evening meal as they go to bed so early). These entertainments were always the same, being long meals of excellent food eaten with chop sticks. The food varies little, usually being first sugared rice, an emblem of good luck, soup with vermicelli cut in strips by hand and tiny bits of tender mutton, small mutton balls or strips of the same with few vegetables, all highly spiced with pepper. For drink, one begins with the everlasting buttered tea and later a native barley beer called *chung*. This contains perhaps one half of one per cent alcohol, as Tibetans are not given to spirits and even rarely smoke, although some cheap cigarettes are beginning to filter in.

Should one be riding in the suburbs or in the city proper, there was always something of interest. Several times we would come upon Shapés in their gold robes, which is Tibetan full dress of high rank. These would be riding in front of about a dozen of their own people, all mounted. On such occasions, we, like all others, would dismount and doff our hats, to be rewarded with immediate recognition.

Never was there such weather! As it was early October, there was a strong frost every night, but in the mornings a brilliant sun appeared in a cloudless sky and remained with us until it set over the western mountains. So dry was the air that all dampness in the ground, after it had thawed, was rapidly absorbed, leaving a perfect terrain not too dusty.

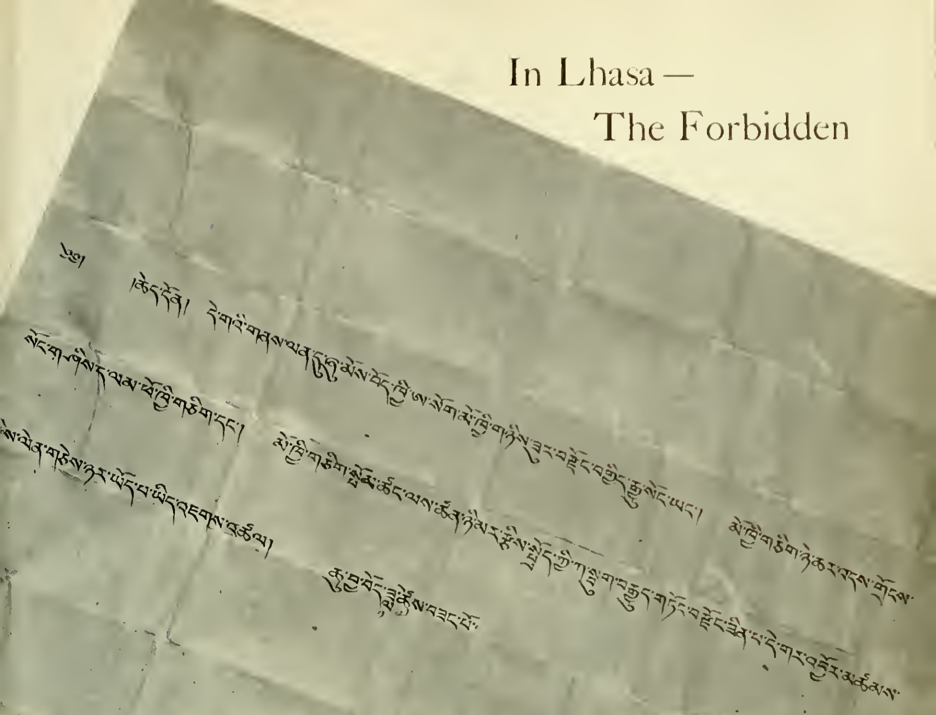
Finally there came what Arthur Vernay and I thought was an appropriate time to take our departure. As at Shigatse, we had received many presents, so we left cards for officials and friends (this is not a Tibetan custom) and started back over the long trail to India. We knew that late October at over 14,000 feet was unpleasant, with cold temperatures and high winds, and we had plenty of them both.

It is to be hoped the reader will appreciate how exceedingly interesting the unique country of Tibet is. There is definitely no reason to presume the country is opening up. It is not. Tibetans have certainly the right to resent foreigners, yet what a shame it is that their country is not more open.

Most people have looked upon the country as a land shrouded in mystery and quite unknown, but this is hardly true. Much romanticism can be written about it, whether the author has actually been there or not, and the material is more apt to be appreciated than if written about any other country in the world, as the name Tibet bears such an extraordinary lure.

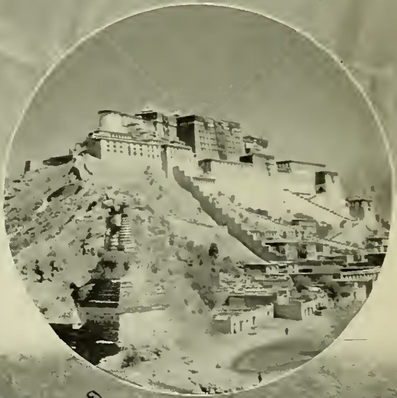
Yet there is still much to be learned of its people and of vast unexplored areas, inhabited or uninhabited. That the people want nothing of the outside world is due to the influence of the priests. This is a country which scarcely knows the existence of the rest of the world. All live their lives in complete ignorance of the outside, and it is fortunate for them that they do, for they are perfectly satisfied, and a healthier or more cheerful lot of people it would be difficult to find.

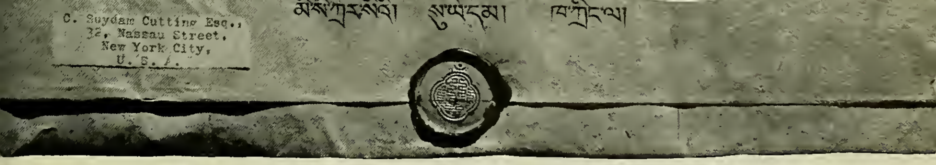
In Lhasa — The Forbidden



(*Above*) *A letter from His Highness the Dalai Lama, written by his scribe. Long correspondence between Mr. Cutting and the Dalai Lama led to an invitation to visit the forbidden city*

(*Right*) *Palace-monastery of the Dalai Lama*
(*Below*) *The envelope which carried the above letter*





C. Suydam Cutting Esq.,
32, Nassau Street.
New York City,
U. S. A.

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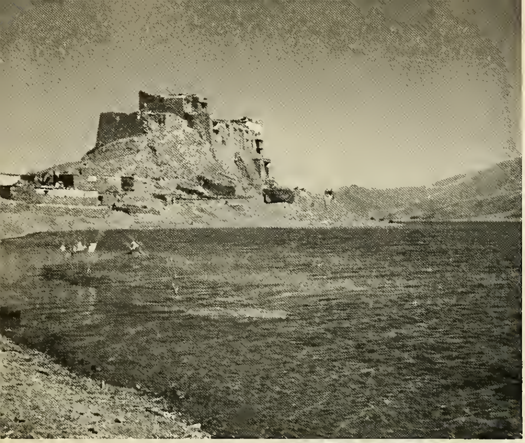
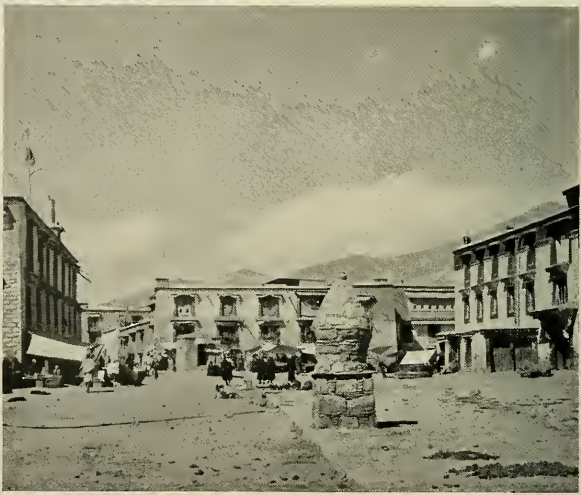


On the trail to Lhasa. The Fort of Penadzong on the shore of "the Lake of the Nomads' Upper Pastures" (Yamdrok Tso). Note the Prayer flags in the water



(Right) Streets in Tibet are broader, cleaner, and less congested than in most other eastern countries. A square in Lhasa

IN THE LAND

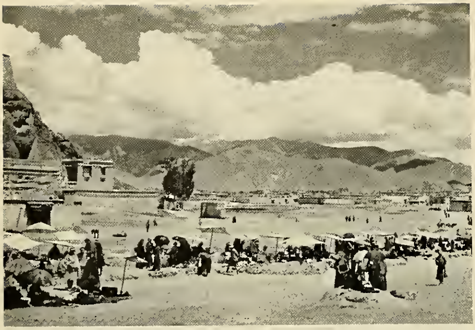
(Left) A lama school. Here under the trees near the lamasery of Drepung the students are taught Buddhist text

(Right) The caravan on trail at 14,200 feet between Sikkim and Shigatse, which is the spiritual capital of Tibet and was the expedition's first objective

(Left) A typical courtyard of a Tibetan house where the caravan passed the night. The houses are well built and amply comfortable

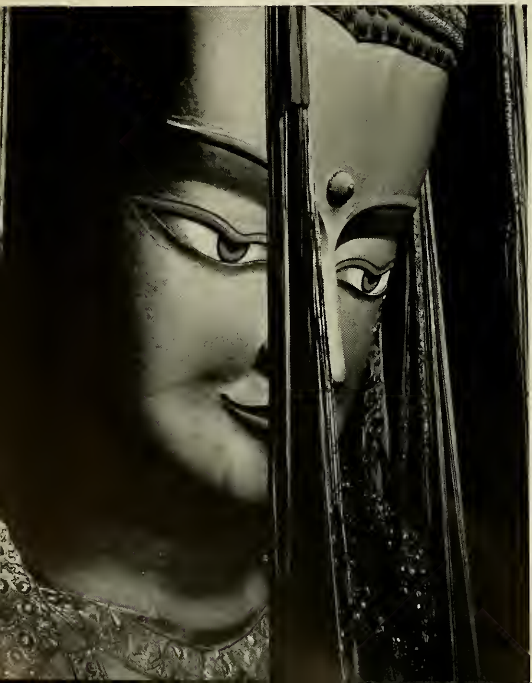
OF THE LAMAS

(Right) A halt for tea in a Tibetan home. The people of all ranks are charming, hospitable, and full of good humor

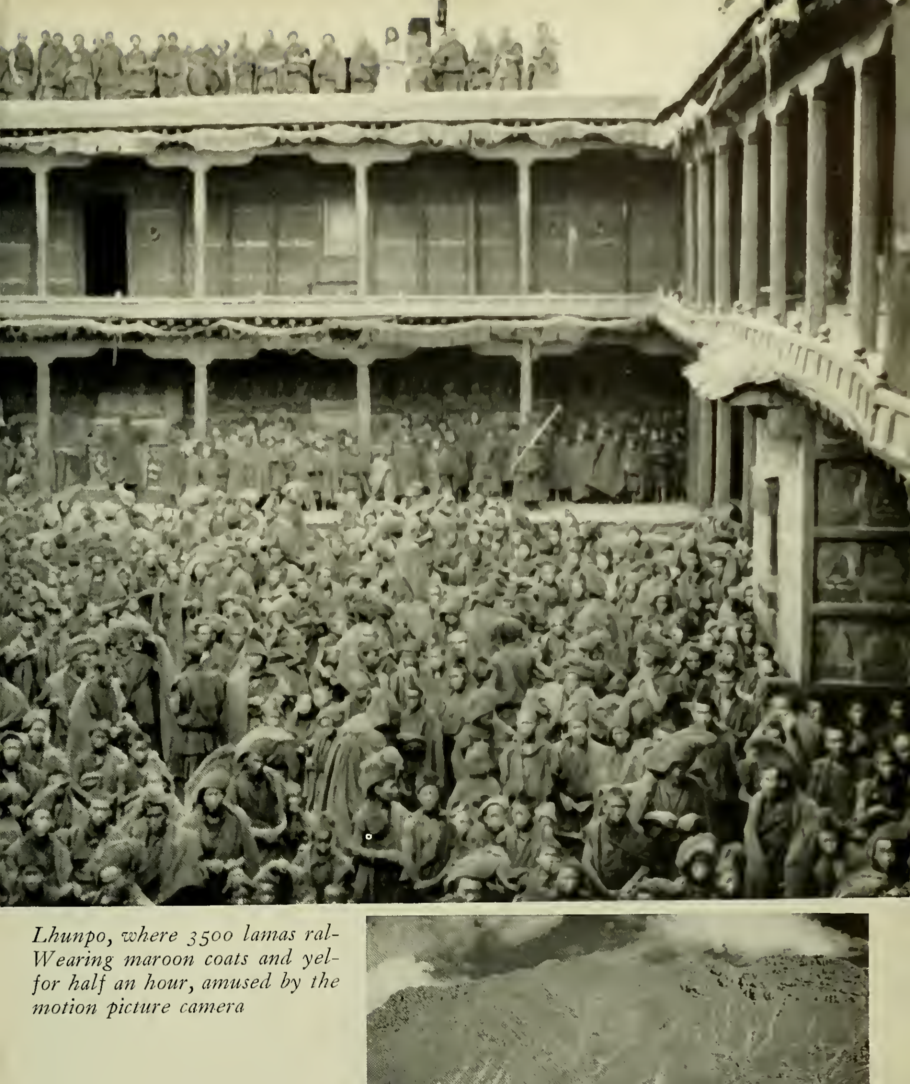


A portion of the bazaar of Shigatse. Situated at 12,800 feet in a huge valley surrounded by mountains, Shigatse is the official residence of the spiritual head of the Buddhist world, the Tashi Lama

Head of the largest Buddha in Tibet. The photograph is taken from a height of thirty feet. The face is of gilded wood

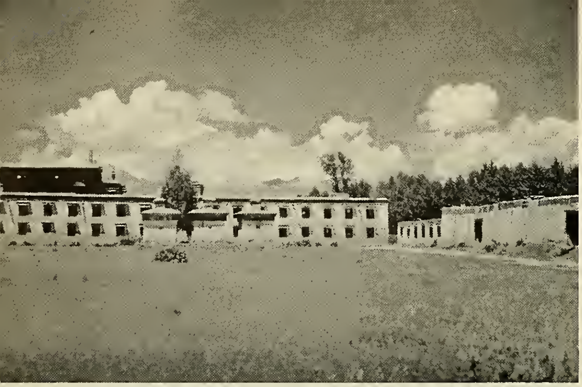


In the great lamasery of Tashi
lied to greet the expedition.
low hats, the throng milled about
visitors but undisturbed by the

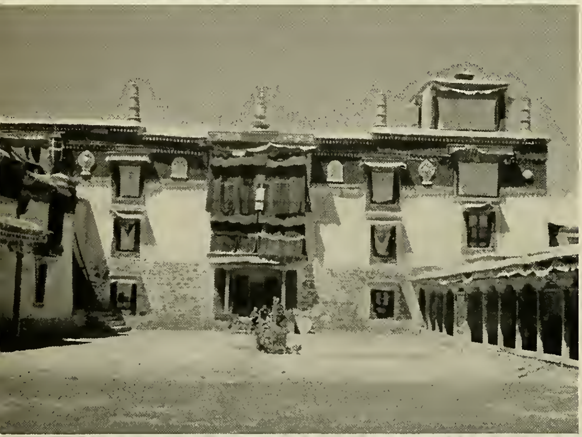


Lhunpo, where 3500 lamas ral-
Wearing maroon coats and yel-
for half an hour, amused by the
motion picture camera

The famous lamasery of Tashi Lhunpo. Its many gilded roofs dominate the landscape

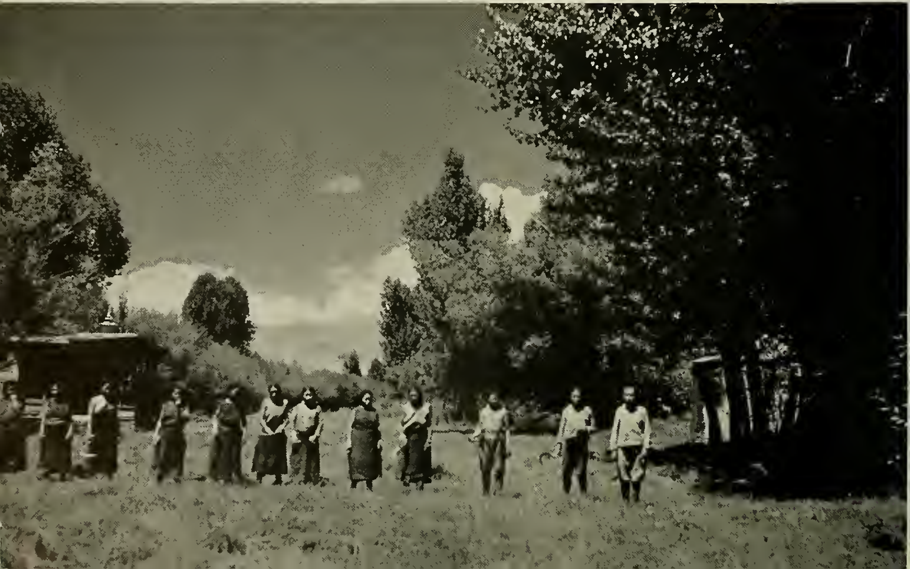


(Left) Exterior of the summer palace of the Tashi Lama at Shigatse



(Left) Private quarters of the Tashi Lama in his summer palace

(Below) Workers in the garden of the summer palace

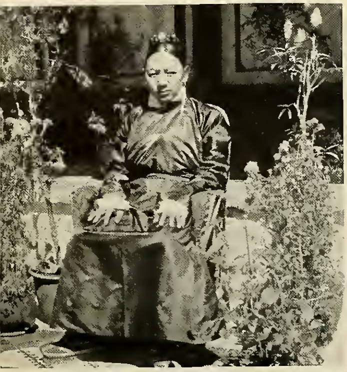


(Right) From the fort, looking across the roofs of Shigatse

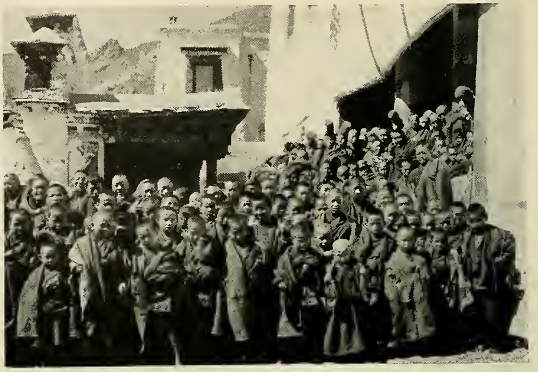
(Right) The fort or Dzong, where the Civil Governor resides

(Below) Regiment in Shigatse on dress parade in honor of the expedition

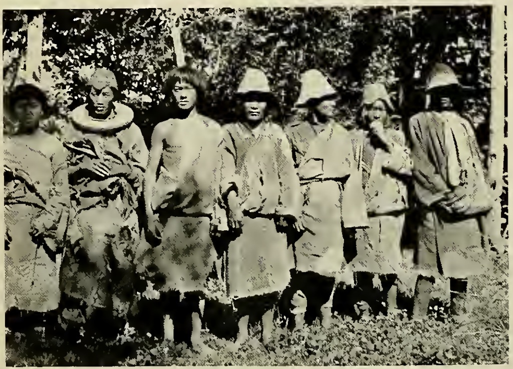
The Prime Minister, Si Lon Yapshi Lon Dun



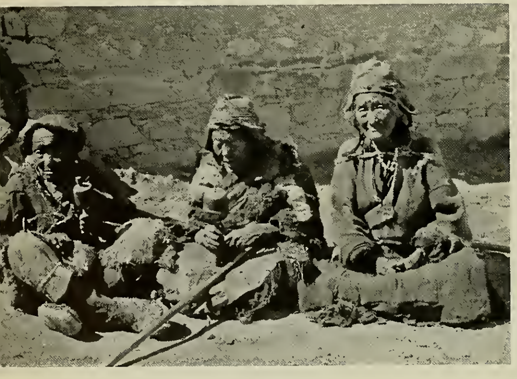
Acolytes in Lamasery of Drepung



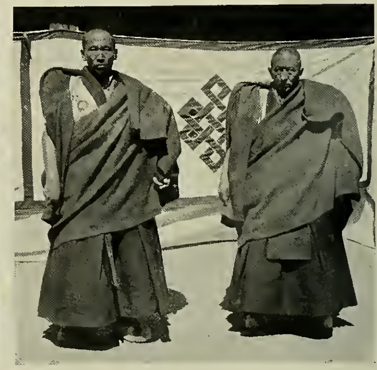
PEOPLES



(Left) Rakyabars, disposers of the dead

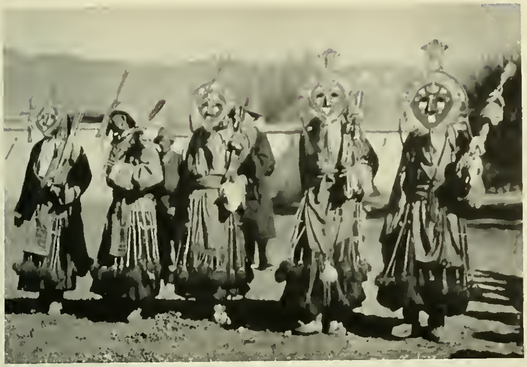


Beggar women of Shigatse

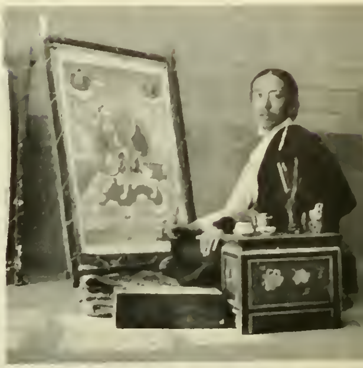


High Lamas, Drepung Lamasery

Professional dancers, Lhasa

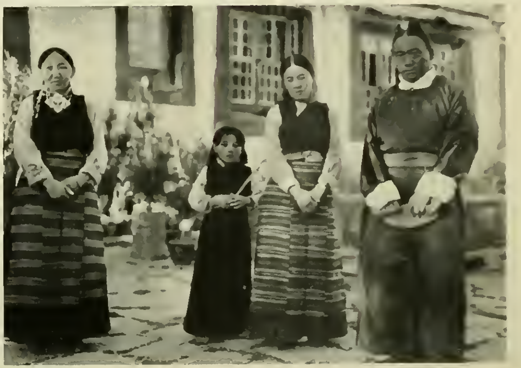


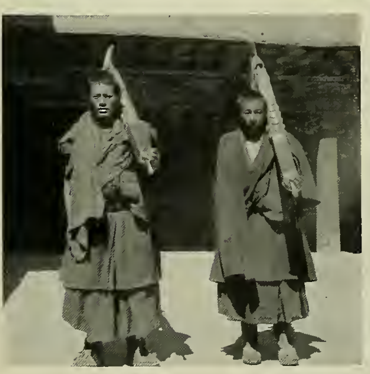
A famous painter of Lhasa



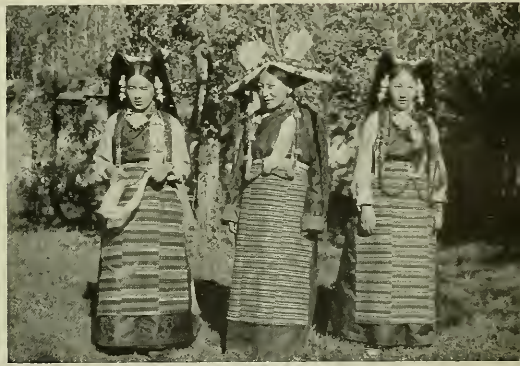
OF TIBET

(Right) A family of high degree





Lama police in Drepung



Noble ladies from Shigatse and Lhasa

Northwest entrance to Lhasa. Being a holy city, pedition consulted the Tibetan almanac and

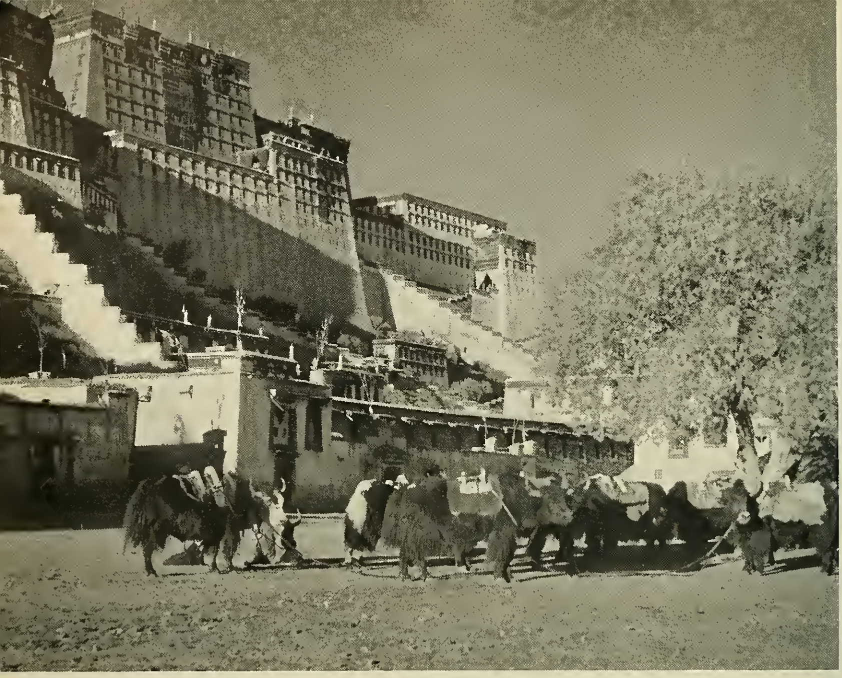
(Right) Looking over the roofs of Lhasa toward the Potala

(Below) Guards at the entrance to the Dalai Lama's summer palace. The uniforms and rifles are from India

it can be entered only on a lucky day. The ex-
planned their arrival accordingly

(Left) An avenue in the summer estate of the Dalai Lama at Lhasa

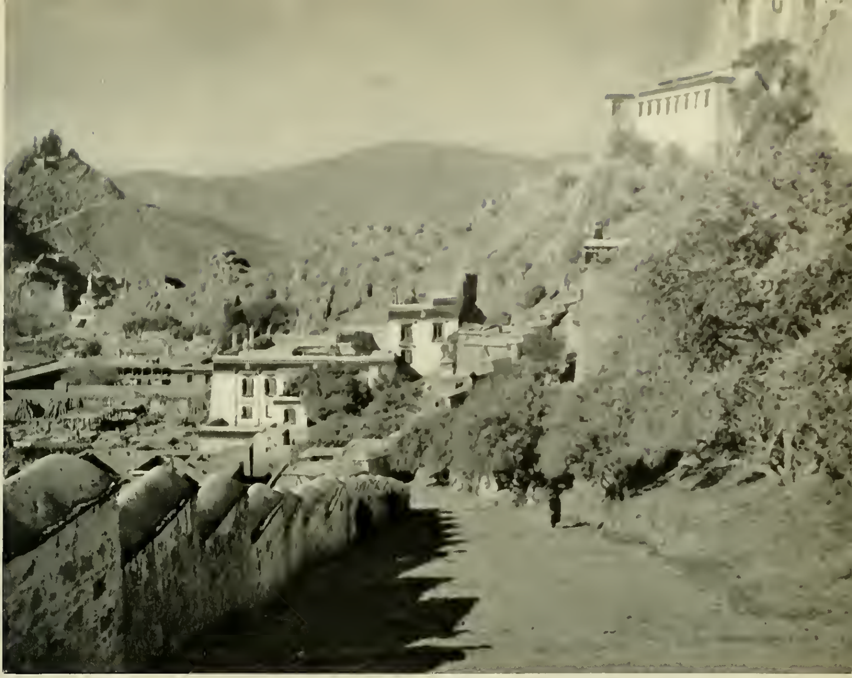
(Below) The expedition's headquarters in the forbidden city, a comfortable house in an enclosure of poplars and willows



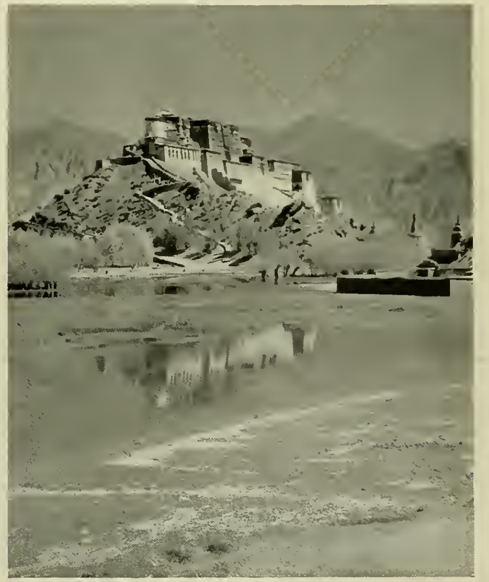
PALACE-MONASTER

(Top) The famous Potala. A building seen by few explorers, but one of the most beautiful structures in the world

(Right) A stairway leading to the section of the Potala which is the official winter palace of the supreme ruler of Tibet. The enclosed courtyard shown directly above is on the very top of the building

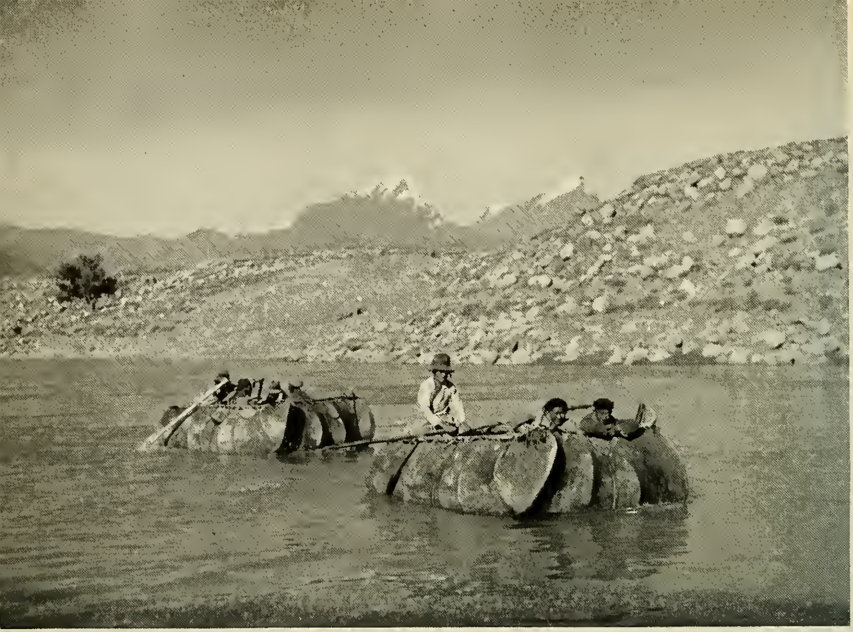


OF THE DALAI LAMA



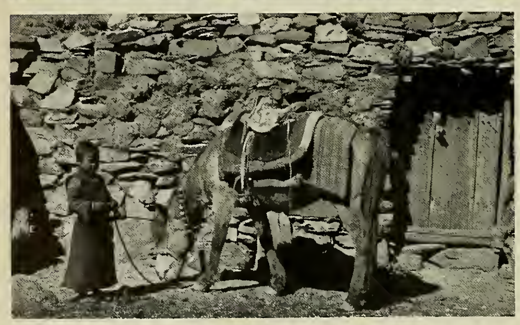
(Above) A lower stairway of the Potala

(Right) An impressive building in all its majesty and mystery. The Potala was begun perhaps in the tenth century, but renovations in the early seventeenth made it what it is today



Tibetan coracles on the Tsang Po (Brahmaputra) River which conveyed the expedition ten miles down stream

(Center) Yaks grazing on the shore of Yamdrock Tso, "the Lake of the Nomads' Upper Pastures"



(Left) A young groom who tended Mr. Cutting's horse during a halt

Bird Voices in the Southland

Making "talkies" with an all star cast of native American birds

By ALBERT R. BRAND
*Associate in Ornithology,
American Museum of Natural History*

PHOTOGRAPHS BY ARTHUR A. ALLEN, P. PAUL KELLOGG, AND JAMES S. TANNER

Magellan braved all seas that roll,
Commander Peary found the Pole,
Leander swam the Hellespont,
But I have tramped across Vermont.

THUS did Arthur Guiterman sing of the explorer who stays at home. Strange as it may seem, it is not always necessary to travel great distances to foreign lands to bring back interesting and valuable results. Right here in the United States there are treasures to be sought; treasures that in a few years may be past obtaining. The frontier is gone, but even today there are areas of no inconsiderable magnitude practically unexplored; and one need not even go so far as our newer west, for, though they are becoming scarce, little-explored regions still exist on the Atlantic seaboard and in the Mississippi Valley.

In February, 1935, a joint expedition of the American Museum of Natural History and Cornell University set out on such an intramural undertaking. The object: photographing native wild birds and recording their voices. Particular attention was given to species that, because of the fast development of civilization or for other reasons, are becoming rare.

Dr. Arthur A. Allen, professor of ornithology at Cornell University, led the party, his special province being bird photography, both still and motion pictures; he also directed the ornithological observations, and arranged the itinerary; the writer, whose major interest for several years past has been recording sounds of native birds, accompanied the group on the journey into the southland; Paul Kellogg, instructor of ornithology at Cornell, was the technical expert in charge of sound recording; Dr. George M. Sutton, a distinguished bird artist and curator of birds at Cornell University, joined the party in Florida and Louisiana, and contributed a number of water color sketches of the rarer and more unusual species; and lastly, James S. Tanner, a graduate student, accompanied the expedition as camera-man assistant, sound recording helper, cook, and general handy man.

The sound equipment

One bleak morning in mid-February, two small Ford trucks loaded with cameras, sound recording paraphernalia, and camping equipment pulled out of Ithaca, New York, headed southward.

The trucks, besides transporting the party, served two other purposes. They sheltered the men for at least half the time afield, and proved that one can rest quite as comfortably in a truck as one can, let us say, in the more conventional Pullman berth. In addition, one Ford was especially adapted for sound recording. In it were mounted amplifiers, sound cameras, and several hundred feet of cable with which to connect the microphone in the field and the equipment in the truck; also this vehicle carried the sound mirror and its tripod.

The sound mirror or reflector is a large circular disc—a section of a parabolic curve—some three feet in diameter. At the focal point of the parabola the microphone is set. The result: when the combined microphone and parabola is focused upon a singing bird, the song is greatly amplified. All other sounds not directly in the beam, however, reach the microphone in only normal volume. The object of this device is to reduce outside or ground noises, which frequently ruin otherwise excellent outdoor recordings. The mechanical ear, as the combined microphone and parabola has been called, is set on a tripod, and hooked up to the amplifier and sound camera in the truck. Most of the recordings are made using the microphone in combination with the parabolic reflector, but occasionally it is expedient to use the microphone alone.

On the prairies of Florida a six-foot diamond-back rattler was encountered. In this case the microphone was dropped close to the subject—closer no doubt than the recorder would have dared to be himself—and the snake rattled directly into the recording device; and again in a heronry in Louisiana the microphone was set among the nesting birds, and the various raucous honks, rattling croaks, and peculiar squawks were faithfully recorded.

The photographic equipment

The second truck was used for photography. The Akeley camera and its substantial tripod, kindly loaned for the duration of the expedition by Mr. Duncan H. Read, was most useful and brought beautiful results; but it was a bulky affair, requiring much room, and was no joy to lug a half mile or more through virgin forest and swamp. In addition, there were several other moving picture and "still" cameras. The roof of this truck was fitted with a collapsible platform or tower, similar to those used on public service corporation repair trucks; and often the photographer stood his camera on the top of the truck, and did his "shooting" from there. Occasionally, when we were photographing birds that nested well up in the trees, the roof was not sufficiently high; then the platform was extended to its full height. This enabled the camera-man to operate from a point about twenty feet above the ground.

Outfitted in this manner the group was ready for a powderless hunt, where camera and film supplanted rifle and shot. The trophies were not to be bird skins, for the expedition was interested in preserving, not decimating, the rare species that are already all too near extinction.

It might be well to consider for a minute what we mean by rare birds. The term "vanishing birds" hardly needs explanation; generally it refers to those species that once were plentiful, but for certain reasons, persecution or hunting or what not, are now on the point of extinction. Every so often we hear of such cases. The wild turkey has all but vanished from a large part of its former range, and the final disappearance of the last lone heath hen in Martha's Vineyard, little more than a year ago, reminds us that, do what we will, if a form becomes exceedingly scarce, all our powers are futile. Protection is of no avail. Fortunately those interesting and beautiful birds, the white herons or egrets, which were becoming extremely rare a generation ago, are again abundant.

One of the most outstanding examples of what one individual can do for the preservation of birds is Mr. E. A. McIlhenny's "Bird City." He has made an artificial pond on his estate so attractive for snowy egrets that, from a small beginning, the birds have now increased to more than 10,000. Through Mr. McIlhenny's courtesy and hospitality the expedition was able to record the curious calls of these birds, and to secure many excellent photographs.

It is to the credit of such individuals as Mr. McIlhenny and of the National Association of Audubon Societies and other conservation groups that these interesting birds are alive today. Through their efforts the birds have been saved for posterity. Not so with the passenger pigeons, however. Hardly a hundred years ago flocks were encountered so large that they literally darkened the skies. The last known specimen of this beautiful bird succumbed in captivity in 1914. Over-hunting—the bird was large, unwary, and toothsome—brought about its destruction; and almost before most people were aware that the species was getting rare it had vanished from the face of the earth.

Rare camera subjects

But what about rare though not necessarily vanishing species? Not all rarely seen birds are on the verge of extinction. There are, we are glad to say, comparatively few forms that are actually close to the border line; but, on the other hand, there are many birds that are commonly called rare. Rareness of a bird often depends upon the locality of the observer. Birds that are very rare in one place, if followed to their breeding grounds may well be as common as English sparrows at home. Others, if not common, are at least of usual occurrence.

Consider for instance Audubon's caracara, a vulture-like hawk, which though common in Mexico and to the south, is found only in a few favorable localities in our southern states. On the Kissimmee Prairie of Central Florida the bird is a common resident, however, and it was not difficult to find nesting birds. This region, perhaps eighty miles long by forty wide, is practically uninhabited. The only signs of civilization are occasional herds of scrawny cattle that eke out a meager existence on the sparse prairie grasses.

The trucks were driven over the pathless wastes to a hammock—a prairie oasis, where a few hardwood trees and cabbage palms manage to exist on the comparatively dry, sandy soil. There, in a large cabbage palm, twenty or more feet from the ground, a pair of caracaras had built their bulky nest. It sheltered two nestlings almost ready to fly; and when a member of the party donned climbing irons and shinnied up the tree, one of the young birds fluttered out. Then followed a chase through scrub palmetto; but the bird was finally captured and induced to pose before the camera. Eventually it was returned to the nest. On this occasion the collapsible tower was most useful, for when extended, the photographer was enabled to work within ten feet of the nest.

Some of the larger birds

Another bird, not uncommon on the prairie, is the Florida or sandhill crane. These large birds are true cranes, not herons; the wing spread is six or seven feet, and when standing erect their height is equal to that of a ten-year-old child. Nervous and wary as they are, photographing them was a matter requiring consummate patience and skill. The voice can be described as a loud trumpeting, rather musical and startling. Toward evening and at dawn these mighty birds fly over, trumpeting as they go. There is something awesome about their loud voices ringing over the otherwise hushed prairie; the peculiar light, the unending, flat, rolling seas of grass and palmetto, give one a feeling of reverence in the presence of powers far greater than those of insignificant man. But the sound recorder has little time for such thoughts; he must be alive to his opportunities. It was at such a time, with the prairie bathed in eerie sunlight and the cranes trumpeting overhead, that the loud stentorian calls were recorded.

Persecution has made the bald eagle a rare species in all but a few of its former haunts. At one time this bird, our national emblem, was common over most of its range. Its great size made it an easy target and, although rarely destructive, it receives protection in less than two thirds of our states. Fortunately on the coast of Florida, eagles are still fairly common, and it was on the east coast that the expedition secured photographs of these spectacular birds.

Wild turkeys also are large birds, and in addition, furnish excellent food. They have all but disappeared except in the wildest and most inaccessible regions; their future is indeed precarious. However, in Georgia, thanks to the coöperation of Mr. Herbert L. Stoddard and Col. L. H. Thompson, a flock was baited up before a blind, and sound and pictures of both male and female birds were secured.

Free from the fear of man

However, there is another side to the picture, and, in certain parts of Florida, birds that are generally credited with being wary and shy, have, to a large degree, lost their fear of man. In central Florida, in the heart of the city of Orlando, is a small lake. Here scaup and ring-billed ducks, coots, cormorants, and gulls congregate during the winter season. The ducks arrive in the autumn, after having migrated from their northern nesting ground. On their journey southward they are subjected to a constant barrage of lead; and on arriving at winter quarters, one would expect them to be caution itself; yet that is not so; they seem to sense that they are protected on this city lake. Here the park attendant feeds them daily, and they have become so tame that they will take food out of his hand. The residents also feed the birds, and it is really amazing to see these usually wary creatures with apparently no fear of their arch enemy, man. Hold a piece of bread in your hand above your head, and gulls will fight for the privilege of grasping it from between your fingers; while coots and ducks will churn the water at your feet in their attempts to get you to hand them a titbit.

At St. Petersburg, on the gulf coast, conditions were similar, and several species of gulls and ducks partook of the festivities. In addition, the brown pelicans have become so tame that on the municipal pier it is not uncommon to see a number of these comical, ungainly birds standing next to the fishermen patiently awaiting a handout. If a fish is caught too small for the fishermen's creel, it is deposited in the waiting pouch of an attendant bird. It was not difficult to get the pelicans to pose for their pictures. A can of live bait, bought on the pier and fed to the birds by the hand to mouth method, lasted but a short time. The sound apparatus could not be used, however; pelicans are one of the few voiceless birds, almost as silent as that silent mammal, the giraffe.

Recording the ivory-bills

The most protracted stay was made in the country of the ivory-billed woodpecker. This, the largest native woodpecker, is a truly glorious bird. Slightly larger than a crow and almost as black, the ivory-billed is much more unusual and startling in appearance, especially if seen on a tree trunk as it works in typical woodpecker fashion. Both sexes have prominent crests; that of the male is a flaring red; the female's is black. When the bird is at rest, great white patches on the wings suggesting white coat tails sharply contrasted against the greenish black of the rest of the body are strikingly prominent. The large bill is ivory-colored, as the name suggests. The species has always been uncommon; of late years it has become so rare that it is on the verge of extinction.

Ivory-bills were sought in several Florida regions, and much time and energy was expended running down every clue and rumor. Professor Allen had observed the bird ten years previously in one of the wilder regions of central Florida; and a local observer reported having seen an individual in the identical region no longer ago than the preceding Christmas. However, sight records of this bird must be taken with caution, for the other large native woodpecker, the pileated, inhabits similar regions. Confusion is all too common, and a trained observer and close observation are necessary for positive identification. Many of the casual reports of ivory-billed no doubt refer to pileated. Nevertheless there seems to be good reason to believe that a few ivory-bills still inhabit the Florida region; but actual specimens were not seen.

In a dense southern swamp, however, the birds are making their last stand. The large waste area is in private hands, but the birds, fortunately, are receiving the protection they so sorely need; and even visiting the region is discouraged. In fact, the expedition spent a full day of valuable time on the long distance 'phone and telegraphing, before permission was granted to enter.

The warden, J. J. Kuhn, acted as guide; he is guarding the birds' last stand and, without his aid, finding the birds would have been well nigh impossible. But the difficulties were not over, even with the granting of permission to enter, and with the enlisting of Warden Kuhn's aid. Miles of virgin swamp and partly submerged lands had to be navigated. As means for transporting the sound equipment and cameras, the trucks were useless; and an old farm wagon and four mules were pressed into service.

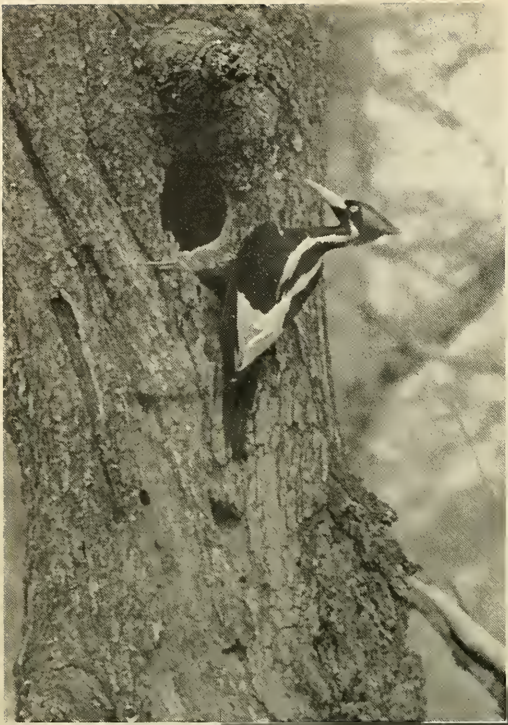
After much searching, a pair of ivory-bills was eventually located. Here, twelve miles in, camp was pitched, and for a week or more, notes were taken, photographs made, and sound recorded of America's rarest bird. Almost exactly a hundred years ago Audubon studied this bird in the same region. It was rare in his time; little careful work had been done since, and many facts of the life cycle of the bird remain unknown. All during the daylight hours, from a distance of about seventy feet, a twenty-four-power telescope was focused on the nesting hole and careful observations were recorded. One or another of the group was on duty with the telescope during the entire stay.

Will the ivory-bill survive, or like the Carolina paroquet, the only native parrot, and the passenger pigeon, is it also doomed? Time alo will tell; but "while there is life there's hope" for several species that had almost disappeared, with changed conditions have later revived. It seems apparent that ivory-bills are having difficulty in bringing their nesting activities to a satisfactory conclusion; and, of course, there is no hope for a species that cannot raise progeny. As yet we do not know the exact cause of nest destruction, but the days of continued study and recording were fruitful, and furnished several clues as to what is causing the decrease. If the causes can be established definitely, it may be possible so to control them that this most interesting form, now almost extinct, can be saved for posterity.

Instead of the skins of birds, more than fifty thousand feet of film—twenty thousand feet of sound, and thirty thousand feet of motion pictures—were taken from the field, to be preserved for future study. It is hoped that the rarer birds may be saved for the benefit of future generations: if that is impossible, at least we shall have pictorial records of them; we shall know what their vocal attainments were—a poor compromise at best—but far superior to a record consisting of only written words.

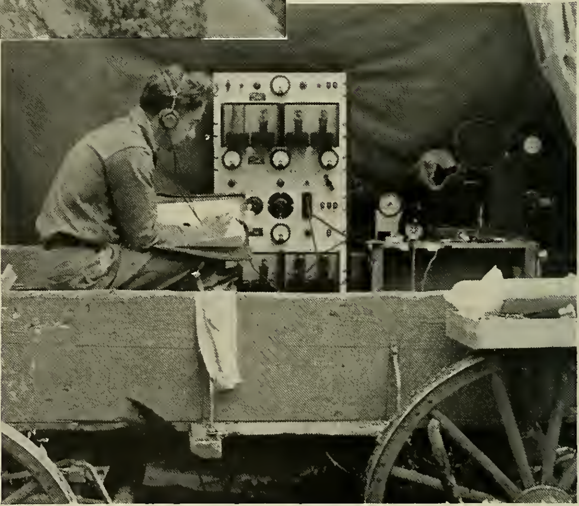
These laughing gulls were unusually tame, as are many Florida birds. The northern visitors feed them. A minnow thrown into the air in front of the photographer made this picture possible. The minnow never reached the ground

Bird Voices in the Southland



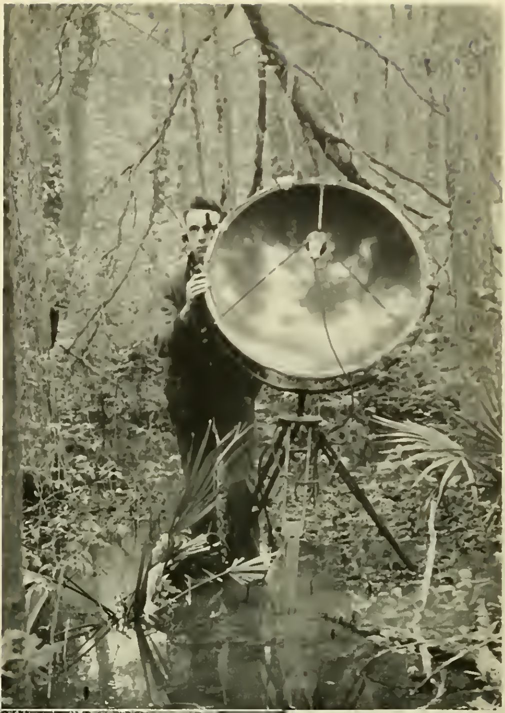
THE IVORY-BILL

The ivory-billed woodpecker, one of the last of his kind, poses for his portrait. This bird, the rarest in the United States, is larger than a crow. Why he is so nearly extinct is a puzzle. The data accumulated on the expedition may throw some light on the subject



(Right) To transport the delicate sound-recording apparatus into the ivory-bills' country it was necessary to dismantle the automobile sound truck. The apparatus was transported through the swamp in a farm wagon and reassembled at camp. Mr. Kellogg, during a take, carefully keeps record in a notebook, as well as on sensitized film

The mechanical ear, in a swamp in the deep South, recording the sounds of the ivory-bill. The microphone is set at the focus of the parabolic disc, and the apparatus is then centered on the bird. This device greatly amplifies the desired sound



GOES ON RECORD

(Left) Professor Allen studies the ivory-bills. Continuous observations were made for five days; one or another member of the expedition watched the nesting hole through the twenty-four-power telescope during all daylight hours and kept a log of the birds' activities

(Left) Wild turkeys are still to be found in sections of the South, though they are scarce everywhere and much in need of protection

(Left Center) A limpkin watches from the opposite shore as one of the party climbs to the nest. The bird is oblivious of the fact that it is being photographed from behind

(Lower Left) Lesser scaup ducks spend the winter season in a lake in the heart of the city of Orlando, Florida. Many other residents of the North do likewise. Protection and feeding have made the birds so tame that they will come almost within reach if offered a little bread

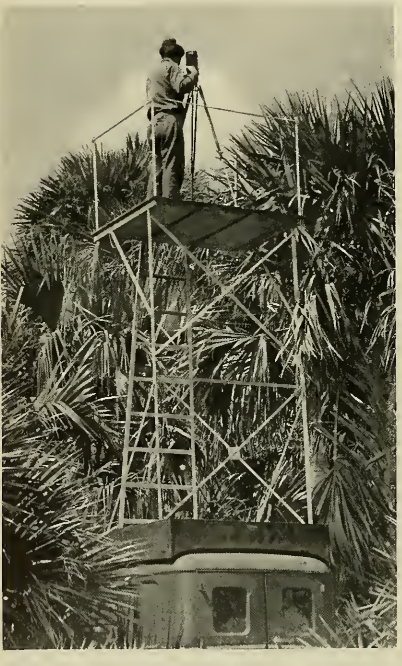
ON LAND ON WATER IN THE AIR

(Above) A quizzical old pelican flaps past at close range. Beautiful he is not, but graceful and admirably adapted for his special mode of life

(Upper Right) The ospreys or fish hawks make a huge nest which they inhabit year after year, adding to it and repairing it from time to time. Fine recordings of their voices were obtained

(Lower Right) In order to listen in on a little snowy heron gossip, the operators set the microphone among the nesting birds. Excellent recordings of their peculiar squawks and honks were made which, though faithful, are anything but lovely. Herons should be seen, not heard

(Left) On Gandy Bridge between Tampa and St. Petersburg, Florida. Pelicans benefit from the sun's rays. At rest and close at hand these birds look most ungainly, but in flight and when diving, they are grace personified

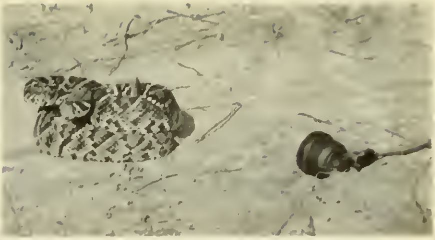


(Above) The wood ibis is becoming extremely rare, and the expedition considered itself fortunate to come upon this rather large flock of these ungainly birds

(Left) Here Mr. Kellogg is using the collapsible tower on the truck as a point of vantage in photographing Audubon's caracara

(Below) The loud speaker was set in the territory of this mockingbird, and film of an earlier recorded mocker was played. The bird seemed quite upset; a loud speaker rival was a new experience

(Right) A Florida diamond-backed rattler poses for camera and "mike"



(Below) A Louisiana heron swain presents his lady love with a twig. During the whole period of incubation and even after the young are hatched, the old birds continue to bring nesting material to enlarge and improve the nest

(Above) The Kissimmee Prairie from one of its hammocks—home of the Florida sandhill crane, Audubon's caracara, vultures, American egrets, and many smaller and less rare birds

(Above) Thirty feet up in the top of a cabbage palm was a caracara's nest containing two nestlings almost ready to fly

(Left) The young caracara hopped out of its nest when one of the expedition party approached too close. The bird was pursued through the scrubby palmetto undergrowth and finally "induced to pose before the camera"

On Safari in America

A woman's story of a dinosaur hunt in the wilds of her native land

By Mrs. Barnum Brown

Seeing America last has opened up horizons in my native land that the ordinary traveler or stay-at-home little dreams exist. Sometimes the farthest mountain shines the brightest, and the moon in Mandalay may seem the softest, but here within our reach are scattered scenes of beauty to be had for the seeking. A safari in America can offer as many thrills as one in any other part of the world.

Sometimes the Hunter and I followed the elusive trail of the dinosaurs with pack and saddle, pitching our tents beneath the stars, along the old "hoss" trails of the golden west.

Again we rambled by motor through the flaming glory of the Grand Canyon, the soft pastels of the Painted Desert, or the shadowy beauty of the Black Hills.

Today finds us hunting "dinos" with a Stinson plane, covering in one week the horse and motor journeys of an entire year. The methods vary, but the end's the same—bigger and better dinosaurs for the American Museum.

Short scouting trips can yield rich treasures, dinosaurically speaking, and several of our prospecting parties consisted of just three: Doctor Brown, his assistant, and myself. The first two were the prospectors, while I constituted the party.

A rare find

One day the dinosaur hunters returned to camp with the glad news that they had found a rare carnivorous dino, which might have been cause for alarm, save for the fact that his flesh-eating days had been numbered some hundred million years or more ago.

On Beauvais Creek, in the Crow Indian country, the pursuers found a new, low-plated dinosaur, the only one with a skull known from this age. Day by day the solid sandstone hill was chipped away from the skeleton, until another strange beast came to light—a huge, horned-toad-like creature that resembled the modern lizards of today.

A kangaroo-shaped freak, with long hind legs, short front ones, very long tail, and duck-like beak, also fell to the lot of the dino hunters on this trip, and this, together with the "Dreadnaught," joined the parade of queer animals headed for the halls of the Museum. And the Hunter's name is Barnum.

Wanderers

"Where my caravan is resting" could not be sung of these short trips, because we seldom stayed more than a day or two in one place, and camp equipment for these one-night stands must vary with the individual. There are, however, three items of great help to the wanderer. They may be found everywhere, and do not constitute excess baggage. These are tolerance, love of beauty, and a sense of humor. With these three requisites in the old kit bag, one can journey to the ends of the earth.

While the Doctor is in the field hunting big game of other days, my hours are filled from sun-up till sun-down; for a woman in camp must often play the various rôles of secretary, photographer, cook, camp-wrangler, as well as wife. Perhaps the most important is the secretary's job, for camp records must be kept to date, as an impression once lost is difficult to remember accurately.

Domestic duties vary with the expedition, as does the camp menu, which usually consists of the all inclusive American can, and a side of ham or bacon, mixed with a generous supply of creative instinct, cooked on a gasolene stove, and served with a dash of imagination. Again the methods vary, but the end's the same—ham and—

On large expeditions where we have a cook, I still must plan the meals, keep records, and manage supplies, which is sometimes more complex than doing things myself.

Along camp trails

Since I cast my lot with the Dinosaur Hunter, we have pitched our tents on far-flung trails—in distant India, Burma, Egypt; on the golden Isles of Greece. Wherever the ghosts of the dinosaurs have beckoned, I have tramped along with the Hunter, and I learned about camp life from him. Camps may come, and camps may go, but the expedition must go on, despite personal vicissitudes and discomforts.

Along American trails there are conveniences not to be found in foreign lands, except perhaps in India, where the spacious government (dak) bungalows vie with our tourist camps. Our camps are more numerous and elaborate, however, and the weary wayfarer gladly seeks these havens of rest, where the hardships of setting up tents at night fade into dreams in a comfortable bed, with bath.

The most beautiful camps I found in the Black Hills of South Dakota, where we spent several days searching for dinosaurs near the classic ground where later roamed the great titanothere, the saber-tooth tiger, and the three-toed horse, their bones now turned to stone, entombed in solid rock.

One night my cabin nestled in the trees, where the night wind, murmuring through the pines, mingled with the quavering notes of the poor-will.

Another night was spent on the banks of beautiful Sylvan Lake, a gem of crystal water, where the moon sank to sleep in silvery splendor on the soft bosom of the lake, guarded by the stern sentinels of Needle Rocks.

Around a bend in the road one is suddenly startled by a face silhouetted against the clouds, and the colossal head of Washington gazes serenely over the trees from the granite top of Mount Rushmore. By his side are Jefferson, Lincoln, and Theodore Roosevelt, with heads sixty feet from crown to chin. This gigantic memorial is one of the greatest sculptures of all time, exceeding in size the famous sphinx of Egypt—an inspiring monument to America's ideals of life, liberty, and the pursuit of happiness.

The Black Hills, in the heart of the west, form a little mountain kingdom, within whose pine forests may be found surpassing beauties of nature. Here the wondering tourist may explore to his heart's content along roads that wind through towering granite walls and woody canyons; petrified forests; hot springs; and subterranean labyrinths that burrow hundreds of feet beneath the earth.

The most fascinating of these underground wonderlands is Wind Cave.

Long ago in the eighties, a hunter, stalking deer, heard the wind roaring on a still day, and traced the sound to a hole in the rock where the wind was rushing out, blowing the grass in all directions. Most people thought his story was imagination, but he finally interested another man, and together they sank a shaft into the cave, and with ropes and torches they explored several miles of passages, later opening up the wonders to tourists.

As one descends, the cavern opens into a labyrinth of passages lined with shining crystals of various forms and color; some of these passages are so narrow that one has to squeeze through; others are of huge dimensions like cathedral halls.

Crystal fairylands

In "The Queen's Drawing Room," festoons of crystal draperies adorn the walls, hanging in shimmering folds from the ceiling, while the floor is carpeted with opalescent gems. "The Garden of Eden" is a maze of shining light, where trees, and flowers, and frozen dewdrops glitter like sparkling jewels. Foamy white crystals, like summer clouds, adorn the walls of a secret passage known as "The Pearly Gates," as though one had suddenly awakened in the heaven of imagination.

In this wondrous cave, now a National Monument, one can wander through a hundred miles of crystal fairyland, entombed beneath the surface of the earth.

Surrounding the Black Hills are rocks formed in ocean beds of long ago, where we found the remains of a swimming reptile, or prehistoric sea serpent, whose twenty feet of serpentine body once glided through the waters of an ancient sea.

As we leave the beautiful Black Hill country, a pillar of volcanic rock, known as "The

Devil's Tower" is seen for many miles, rising like a monument to forgotten time. Geologists tell us it was a volcanic plug that was pushed upward and cooled, forming a basaltic column while still under cover.

But the Sioux Indians have a different explanation. According to their legend, two Indian children were chased by a bear. To save them, the Great Spirit pushed the earth up where they stood, and as the column rose, the bear left claw marks on the sides of this pillar of rock.

Contrary to popular opinion, the dinosaurs which we search were not all large creatures. One of the smallest known was located in this region—a pygmy no larger than a hen turkey, with a huge head, and dagger-like teeth; probably a small tyrant of those early days before the dawn of human kind.

Our caravan rolls on, until one day, on a lonely hillside in Wyoming, when the purple haze of evening is veiling the valley, we come upon an unknown burial ground of the dinosaurs, where thousands of bones are crossed and crisscrossed in a common grave; those of mighty monarchs fifty feet in length mingled in death with others of more lowly size. Thus was discovered the Howe Quarry, second in size only to the great Dinosaur National Monument at Vernal, Utah.

The Howe Quarry

In 1934 the Sinclair Refining Company championed the cause of the dinosaurs by financing the American Museum-Sinclair Expedition, and the first crew left for the Howe Quarry in April to start uncovering the bone yard.

Tent City was aptly called "Dinosaur Camp," where a handful of tents, clustered together in a little green valley, sheltered the personnel of the expedition. Some called it "Question-mark Canyon," possibly because of the eternal queries that hovered about like wraiths over the dear departed.

Old-fashioned education depended on one's knowledge of the three R's, but our experience in the dinosaur quarry led us to believe it should be the three H's. "How big were the dinosaurs?" "How long ago did they live?" and "How did they come to die out?" The hills must still echo with the many answers.

Camp was never lonely, because news of the great discovery had been broadcast by one Hans Adamson, the expedition publicist. Verily, hundreds of visitors came from all parts of the United States, and some from Europe, to stare, and question, or sit for hours on the bank watching the preparation of this wonderful mass of bones.

A woman's work

My days were divided between conferences with the cook and doing the secretarial work, which in itself was a full time job, and occupied most of my time. Replies must be sent to hundreds of letters, for it seemed as though everyone had suddenly discovered a skeleton in his closet that demanded investigation. The specimens included a petrified flapper's foot, an Indian moccasin turned to stone, fossil snakes and flying fish, as well as numbers of supposed dinosaur eggs.

The letters were sometimes followed by hurry calls for the Doctor, who would jump into his car at the earliest opportunity, and dash perhaps a hundred miles to the scene of the discovery—only to find a distorted rock, or the skeleton of some old horse or cow.

My spare moments (if any) were spent in the quarry, where I could watch, as never before, the complete story of the preparation of dinosaurs from the time they are unearthed until they are exhibited in the Museum.

So delicate is the work after the bones are uncovered, that the final cleaning is done with small paint brushes and awls, after which the uppermost bones are shellacked and hardened to keep them from breaking.

The blocks are then braced with wooden splints, and covered with strips of burlap that have been soaked in plaster. When this hardens, the entire block is turned over, and the same process applied to the other side; thus, when it is ready for shipment, the whole specimen is encased in a protective cast.

Before the bones are removed, the entire collection is elaborately charted, sketched, and numbered, so that when the bones are unpacked, they can be definitely placed in their exact relationship as they were found in the quarry, and parts of detached animals can be associated. Some of these blocks weigh one thousand pounds.

Socially we are the pets of the neighborhood, and make ourselves at home on all the "dude" ranches. Nearest to us, in beautiful Shell Canyon, is the Quarter-Circle Ranch, the spacious home of Bill and Rowena Paton, where "dudes" can live in ease and comfort despite their riding togs.

Camp news

Dippings from the "Dino Digest," our camp news bulletin, give some account of daily topics of interest.

"August 12 was a gala day in camp, when President Davison honored us with a visit. Even the bones were on their best behavior, and showed off very well in their new coats of shellac, and plaster of Paris jackets.

"Young Trubee Davison was so thrilled by the daily doings of Dino Camp that he would gladly have stayed and helped in the quarry."

"Dinosaur and Dinosette (the Browns to you) attended the Old Time Picnic at Hyattville, where the whole country-side turned out, well equipped with lunches. The Doctor and wife were called upon for speeches, which were summed up in the local paper as follows: 'Doctor Brown gave a very interesting talk on his work. His daughter gave a short talk on foreign affairs.' The speeches were followed by acrobatic stunts, and solos, until the saxophone player tooted the final horn. A good time was had by all."

"Carl, assistant manager, had a surprise birthday party. The cake was a delicious sawdust and excelsior 'layer,' with plaster icing. 'Happy Birthday,' in raisins, put the finishing touch to the chef's masterpiece."

"Flash! Fuzzie, our mascot (suspected cross between a sheep dog and a porcupine) presented the camp with quinpuplets. Mother and quins are doing well."

In the early evenings, by way of diversion, the Hunter and I stroll up to the quarry to rest on the bank overlooking the "dinos."

It is easy to roll back the curtain of time 140,000,000 years, to the days when these creatures lived, fought, and died in the shallow lakes that dotted the verdant valley. Heroes or villains of their day, here they were lying together in their last round-up.

This is the spot we love the most at the close of day. The hills are beautiful in the twilight, fading from gold to rose, and into the purple dusk of night. A million stars are in the heavens when we stumble down to our camp beds.

One day Ma, our trusty cook, poked her head out of the tent and cried, "We're snowed in!" We were. For three days and nights the blizzard howled, and when it was at its height, two horsemen appeared on the horizon bearing the sad news that Ma's son-in-law had met with a fatal accident, and she must leave at once. She did. Clad as she was in her blue overalls and leather jacket, her feet encased in gunny sacks to keep them from freezing, she looked like a Chinese refugee; while I, left alone, felt like one. Alone indeed, for the Hunter was flying somewhere up in the blue, on the first lap of his aerial expedition, and I was alone to keep camp for the men.

The gumbo ridge road to our camp when wet was impassable, and the time I was snowbound in Canyon Camp can only be outdone by the time I was rainbound in the selfsame place —another adventure in my life with the Dinosaur Hunter.

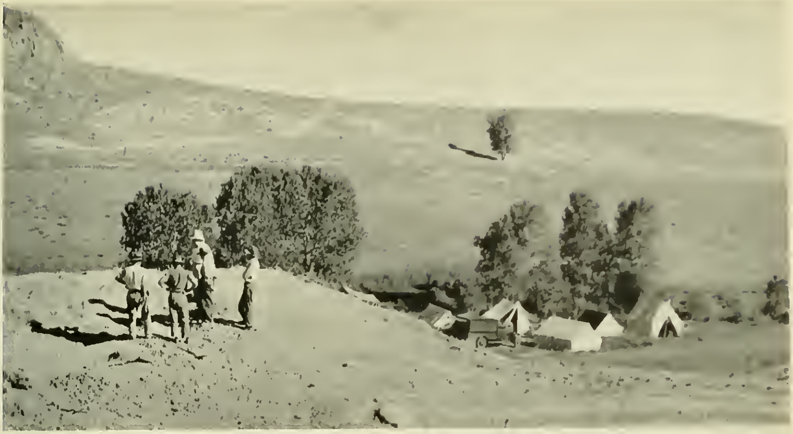
The end of the flight

After six weeks the expedition plane, like a weary bird, sank down to earth again, and the flyers returned to camp to help finish work in the quarry.

They had ended a hazardous flight of 20,000 miles over the mountains, canyons, and Badlands of seven states. They had blazed a new trail of dinosaurs from the air.

So passed the days on the old camp ground.

Many have asked which country holds most thrills for the Dinosaur Hunter. For romance, beauty, and adventure, give me a safari in America.



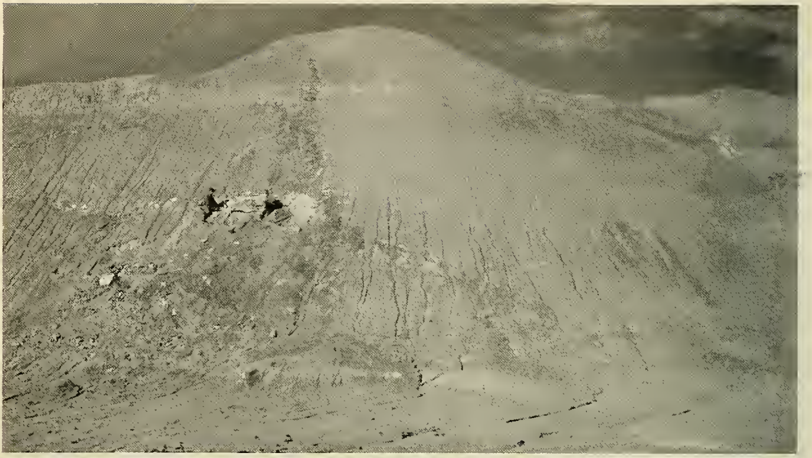
“Dinosaur Camp” in a clump of cottonwood trees a stone’s throw from the Howe quarry near Shell, Wyoming—the only approach a perilous drive over the rim of the hills

On Safari in America

(Right) The Browns start on a dinosaur hunt in the expedition’s Ford truck

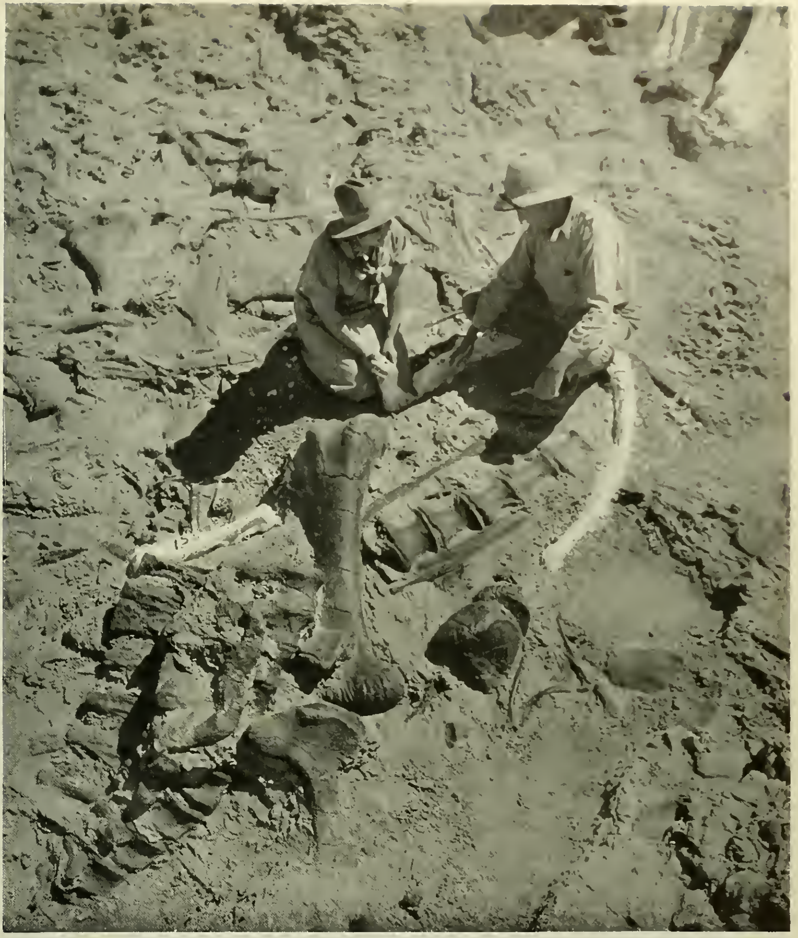
(Center) Anxious moments in camp. Ted Lewis gives “first aid” to Ma Denniger

(Left) Busy moments for the camp secretary. Mrs. Brown kept the camp records, an important job, in addition to her many other duties



(Upper picture) The dangers of dinosaur hunting. In a hazardous location on a steep hillside in the Painted Desert of Arizona the hunters excavate a rare crocodile-like skeleton previously unknown in America

(Lower picture) The sandstone wall near Vernal, Utah, where various museums removed several carloads of dinosaur skeletons. Here the Government Commission is planning the Great Dinosaur National Monument



Personal instruction in the Dinosaur Quarry. Mrs. Brown learns from the Dinosaur Hunter how to clean skeletons—and still live. No one unfamiliar with dinosaur hunters and their regard for fossil bones can appreciate the extreme care and reverence with which they handle their precious finds. Everything must remain as discovered until it can be studied and prepared, and no one dare remove a broken fragment, for it might be important

(Above) Distinguished visitors in camp. From left to right are Mrs. Shea, Mrs. Brown, President Davison, Mr. Lewis, Mr. Shea, Trubee Davison, Jr., Doctor Brown, and Fuzzie, camp mascot

In Camp

(Left) Mr. Bird collects a cowboy outfit from Mrs. Paton, owner of the popular "dude" ranch near Shell, Wyoming

September Snow

(Right) A September blizzard cripples Dinosaur Camp, and delays work in the quarry

(Left) An important event in camp life. A clanging cow bell calls visitors and crew to meals beneath the shady cottonwood trees

(Below) After the storm the men are kept busy repairing the tents

Photograph by Maude Shea

Along the Way

(Above) Majestic peaks of the Grand Teton Mountains, bordering Yellowstone Park

(Left) These weird, fantastic Badlands are the graves of ancient creatures that long since have ceased to roam

(Below) The Grand Canyon near Bright Angel Trail, Arizona

How About the Tent Caterpillar?

An illustration of the Balance of Nature. To what extent is it wise for Man to interfere?

By Frank E. Lutz
Curator, Department of Entomology, American Museum

In the vicinity of New York City the year 1935 was a tent caterpillar year. What that meant for the office force of our department of insect life only those can know who have been at the receiving end of letters, telephone calls, and visits about some insect that has aroused public interest.

It would have been much easier for us if we had been willing to give the simple old advice: burn the caterpillars in their webs and, when winter comes, collect and burn the egg-masses. In fact, not knowing any better, that was the advice we gave, say, fifteen years ago. Since then our doubts about its wisdom have been growing until now we venture to say: "Kill, if you wish, the tent caterpillars on your orchard trees and ornamentals but let Nature take care of the wild trees and *by no means cut down wild cherries*." This called for patient and repeated explaining. Let me try once again, this time in print.

"Balance of Nature"

The tent caterpillar, *Malacosoma americana*, is a native American insect and this fact has an important bearing on the question of what to do about it. If we were considering a foreign insect that, like the Japanese beetle, has been recently introduced without its natural checks, the story would be quite different. But the tent caterpillar has been here for hundreds of thousands—possibly millions—of years; and long before garden clubs and Scouts were organized, or ever man took thought of managing out-of-doors, Nature herself had so arranged things that both the tent caterpillar and natural vegetation, including wild cherries, can live together. The tent caterpillar has been bound by a "Balance of Nature" between it and its environment, including its diseases and insect enemies, in such a way that in any given district the years of caterpillar abundance have been followed by years of scarcity with astounding regularity. If recent organized human interference with natural processes has not thrown the balance out of adjustment, the New York regions that had a peak of abundance of tent caterpillars in 1935 will soon have a scarcity of them for several years. On the other hand, if the balance has been disturbed—well, the result will be interesting scientifically but possibly not pleasing to the wayside committees of garden clubs. When Man interferes with Nature's biological set-up, he is very apt to make a mess of it.

Interference risky

Of course it is true that human civilization necessarily interferes with Nature. The first settlement of white men in America started a whole series of changes in American out-of-doors and the more the country is built up the less "natural" it will be. However, although it seems necessary that we interfere, it is certainly not wise to act blindly or to go too far. The cutting down of wild cherries, the normal food of tent caterpillars, is a case in point.

It has been rather clearly shown by recent work in Europe that when a leaf-feeding species is deprived for several generations of its normal food and is reared on the leaves of some other plant, it will adopt the new food as "normal" and will not go back to the old kind of food except under compulsion. Adult females of the tent caterpillar now place their eggs almost exclusively on wild cherry, but a small percentage lay on apple and related plants, more rarely on unrelated ones. Now, if the moths find no or few wild cherries, all or most of their eggs will be laid on apple and related plants and many will be laid on other kinds of trees. In some not clearly understood way a preference for the new food-plants would almost certainly be passed on to succeeding generations and the result would be that Man's misguided actions would have changed the tent caterpillar from largely an eater of wild cherry leaves to an eater of other leaves, particularly of apple and related plants.

Wild cherries are safe

Man would have "burned down the barn to get rid of the rats only to find that the rats had moved into the house." Not only is this true of the tent caterpillar, but it is true also of scores of other species of wild cherry insects that, if it were not for the wild cherry, might conceivably become feeders on other trees.

Furthermore, many people want the "barn." Therefore, when I have told these people that the tent caterpillar is not as yet a really injurious species, partly because it so largely confines its attention to wild cherry, I have been asked why I place no value on wild cherry. I do. I regret that my own yard is too small to accommodate a patch of them and, were it only for the charm they add to the wayside, I would encourage their preservation along the borders of fields. However, the tent caterpillars, even at their peaks of abundance, do not seriously injure the wild cherries. Three weeks after complete defoliation these trees or bushes are in full leaf again and complete defoliation occurs only in years of caterpillar abundance.

But, should we not do something to prevent even this temporary defoliation? Perhaps we might if we knew more about it and thought that the gain justified the cost. However, we do not yet know enough to be prepared to take over Nature's care of out-of-doors; and some of the things that we have done in the case of the tent caterpillar do not now seem to be wise. This brief article can do no more than hint at the complexity of the situation and the meagerness of our knowledge concerning even this common insect.

Probably most of you have seen the rather motherly-looking brown adults of *Malacosoma americana* but possibly many of you have not recognized them as grown-up tent caterpillars. They appear in early summer, and each female, if in good health, places a band of eggs, laid one against another, around a twig. These eggs are smeared with a frothy material that dries into a shiny, dark brown protective cover, as is shown by the accompanying photographs.

Development of caterpillars starts at once and, if no disease or insect parasite is present, each egg will within a few weeks contain a perfectly formed caterpillar doubled up so that its head and tail are together at the outer end of the egg. Here progress usually stops until the following spring. Occasionally a few of the young caterpillars break through the eggshell and protective covering in August, and more rarely still, whole families hatch; but this precociousness does not seem to be an advantage to them.

Birth to death

When wild cherries begin to break into leaf in early spring, the tent caterpillars that have spent the winter, each in the cramped confines of its own eggshell, come out as though at a signal. Brothers and sisters huddle together on the deserted egg-mass for a while, straightening out their bent bodies, and then they move to their first meal of tender, new leaves. As they go they spin a thread of silk. In fact, a large part of the lives of these caterpillars consists of eating leaves and spinning silk. When clustered together after eating, they move from side to side, spinning the silk that forms the "nest"; when going from nest to food and back again, they spin threads of silk on the bark until the family has delicate carpets on which to walk.

Family life is abandoned when the caterpillars have become fully grown and each strikes out for itself to find some sheltered place in which to spin its cocoon. In the privacy of this cocoon it changes to its pupal form, looking somewhat like a small, fat, brown torpedo. Then quickly follows the marvelous transformation that results in the winged adult.

That, briefly, is the story of a lucky tent caterpillar's life, but by no means all tent caterpillars are lucky. In all of their stages they are in danger of attack by the natural agents that control their abundance. It would be well for Man to learn more about these natural controls and to avoid interfering with them.

There are thousands of kinds of insects that live by eating other kinds of insects. Some catch their prey, kill, and devour it at once. Good examples of these "predacious insects" are the caterpillar hunters, moderately large beetles of the genus *Calosoma*. Others, not very aptly called "parasitic insects," go about their predatory missions in a more leisurely and often complicated manner. Typically, the mother of a "parasitic insect" lays her eggs in her victims. The larvæ that hatch from these eggs live in the victims until they, the parasitic larvæ, are fully grown. Then they may pupate there or they may crawl out to pupate. In either case the victim, rather ironically called the "host," dies.

Helpful parasites

Many of these parasitic insects are wasplike creatures and some are so small that their entire larval and pupal life is passed within a single egg of their host. For example, in the latter part of July Mrs. T. S. Homans kindly sent us tent caterpillar egg-masses from Long Island. Although these eggs had been laid only about a month before they were received, and the caterpillars would, for the most part, not hatch until the following spring, tiny adult wasps were already emerging from them. Twenty-five or 50 were crawling about in the packing box when it was received, and 183 more emerged from 100 of the caterpillar egg-masses during the next month. In nature these wasps would probably have laid their eggs in the eggs of some other moth, the resulting young wasps would have passed the winter in the despoiled eggs of that moth, and adults would have been ready next summer to attack the eggs of a new brood of tent caterpillars. Suppose there had been an organized campaign last summer to collect and burn tent caterpillar egg-masses. The burning would have destroyed thousands of these wasps that Nature uses in her control of not only the tent caterpillar but also of the other caterpillars. We do not, as yet, know what those other caterpillars are, but we may be reasonably certain that, from the human viewpoint, they are undesirable. One of the troubles with Man's interference with natural processes is that its bad effects do not stop with the matter immediately in hand but involve a whole complex of delicate balances.

To be sure, most of the organized campaigns for collecting egg-masses wait until winter, when the egg-masses can be more readily seen. By that time the wasps just mentioned would be out of the egg-masses and escape burning. But that is not the whole story. There are other kinds of parasitic wasps that pass the winter in the egg-masses and emerge very early the next spring along with the tent caterpillars that have not been eaten.

Nature's forces rally

For example, Miss Olsen, secretary of our department, kept a careful record of 100 egg-masses from each of four localities near New York City. About 62,000 tent caterpillars and about 2000 tiny wasps came from these 400 egg-masses in the spring. It is true that destroying egg-masses in those localities the preceding winter would have killed about thirty caterpillars for each destroyed wasp, but we must remember that this was near the peak of caterpillar abundance and that Nature was just building up her forces to control the species. Furthermore, we do not know what good work these tiny wasps do between the time that they emerge from tent caterpillar eggs in early spring and the time that their children parasitize the next laying of tent caterpillars in midsummer. On the other hand, it is also true that a careful study has not yet been made of these parasitic wasps that spend the winter in the tent caterpillar egg-masses. There is a possibility that at least some of them were "secondary parasites" living at the expense of the wasp larvæ that had earlier eaten eggs of tent caterpillars. Clearly, "secondary parasites" that kill the "primary parasites" that kill the tent caterpillar are friends of the caterpillar and it might be to Man's advantage to get rid of them. Quite as clearly, however, the situation is so complex that, without more knowledge of the facts about insect life in general and about the natural history of the tent caterpillar in particular, we are not ready for drastic interference with Nature's balance.

But what about the tent caterpillars that do succeed in hatching? In years of caterpillar abundance caterpillars are certainly abundant. Miss Olsen's figures showed an average of 155 caterpillars per egg-mass last year, even including the parasitized masses. As an example of occasional abundance, Mr. A. Klein brought me a prize twig having eight such egg-masses on less than a foot of twig. Before considering

Nature's further checks, let us look at the simple matter of starvation.

Natural control

Suppose the wild cherry bushes or trees in a given area could support an average of 500 tent caterpillars each. In a peak year there might be an average of ten or more egg-masses to each wild cherry. Taking 150 as a rough average of the number of tent caterpillars hatching from each egg-mass, there would be 1500 or more caterpillars to be fed by trees that could feed only 500. In such a case the only caterpillars that would not starve before they were able to mature and leave progeny for the next year would be the few that were lucky enough to be on isolated bushes upon which only two or three egg-masses had been placed by the previous year's moths.

Now suppose that well-meaning people had encouraged children to gather egg-masses in the previous winter and that the children had been so thorough that they got eight or nine out of every ten egg-masses. That would leave an average of one or two egg-masses or about 200 caterpillars on each 500-caterpillar wild cherry and, so far as food supply is concerned, all could come to full-fed maturity in an area where few would have done so if the well-meaning people had let Nature alone. Furthermore, those 200 caterpillars per average bush would not suffer from other effects of overcrowding such as contagious diseases.

The working of disease when the caterpillar population is dense was very vividly illustrated in a waste field near my home last summer. Before the caterpillars were half-grown, dead individuals were seen here and there, and a week later there was scarcely a nest in the whole field that was not festooned with the limp skins of dead and dying. There will be very few tent caterpillars in that field next spring.

This epidemic of caterpillar diseases was not so striking in my own yard but it was there. I had purposely allowed several families of tent caterpillars to remain on each of my two apple trees and did not spray the trees. (If the owner of apple trees wishes a crop of good apples he should spray to kill the larvæ of the codling moth—a foreign insect—plum curculio, and other pests. These sprays also kill tent caterpillars. Therefore, when a tree-owner complains that tent caterpillars are eating his apple leaves, we need not feel very sorry for him, because it is evident that he was not taking good care of his trees at any rate.) Long before the usual time for the tent caterpillars to leave the trees in their search for a protected place in which to spin cocoons and pupate, many of the caterpillars became restless and crawled to or near to the ground. Most of these were sick, some of them apparently having the same disease that caused the wholesale deaths in the waste field, others apparently having something else wrong with them. From time to time I caged samples of tent caterpillars that were leaving my trees. Of 880 such caterpillars only 117 lived to spin cocoons; and of these only about 50 emerged as moths; and most of these adults were so deformed and sick when they emerged that they were in no condition to perpetuate the species. Natural control was certainly acting in my yard.

Nature's time-tested technique

As was discovered some years ago by Mr. Brown at our field station for the study of insects, another important disease affects the ovaries of the adult moth, preventing her from laying eggs. The importance of parasitic insects in controlling the abundance of plant-feeding ones can scarcely be overestimated. How important in comparison with diseases they may be in controlling the tent caterpillar we do not know. It is quite possible—indeed, it seems almost probable—that, in the case of a gregarious species such as the tent caterpillar, diseases may be the more important. Possibly if we knew more about these and other diseases affecting insects, we could keep cultures of the various diseases on hand and spread them in places and at times that would be to our advantage; but at present, not having the knowledge, it would seem wise to avoid doing anything that might interfere with Nature's time-tested technique.

I have already referred to the insects that parasitize the eggs; but caterpillars that succeed in hatching are by no means free from their insect enemies. The majority of parasitic "wasps" and flies wait until their "hosts" have hatched. The list which the U. S. Bureau of Entomology and Plant Quarantine kindly sent me records 6 kinds of wasps reared from the eggs and 37 kinds of wasps and flies reared from the larva and pupæ of the tent caterpillar. From the relatively few cocoons of the tent caterpillar that we collected last summer we reared scores of these parasites. They emerged in mid-summer and, since the next chance they could have at tent caterpillars would be about ten months later, they undoubtedly attack some other kind of caterpillar in the meantime.

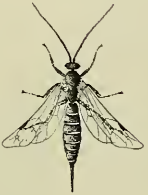
Nature's cycle

Well, I have given you a very sketchy account of some of the troubles that beset tent caterpillars. In my own neighborhood they were so abundant last year that the death rate from starvation, disease, and insect enemies was extremely high. As a result, I expect far fewer tent caterpillars there next season. And, since both diseases and insect enemies increased last year and will probably be carried over the winter, I expect that such tent caterpillars as there are next season will have a very hard time. Consequently, there probably will be still fewer two years from now. Eventually the diseases and insect enemies will largely die out, because families of tent caterpillars will be relatively few and far between. Then the number of tent caterpillars will increase again to a peak, completing the cycle. Meanwhile, the wild cherries will not have suffered serious injury and, with a little care on our part, neither will our orchard trees and ornamentals.

Unknown factors

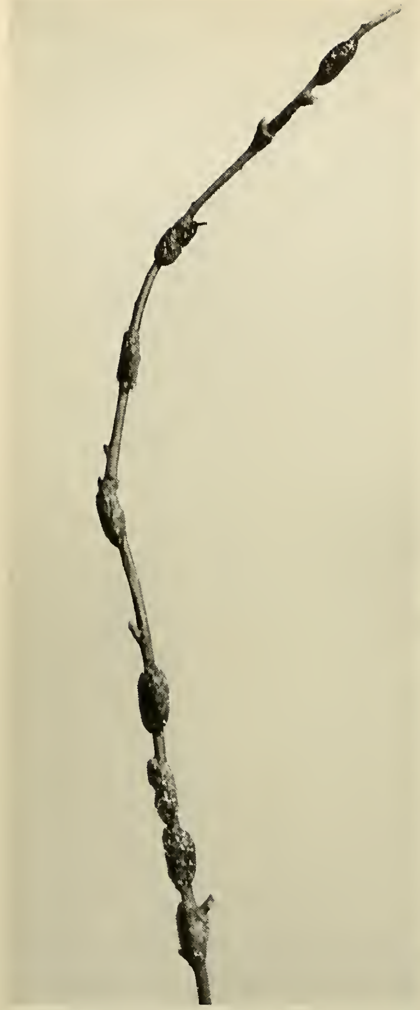
It is for such reasons as these that we now discourage so far as we can Man's wholesale interference with Nature's control of the tent caterpillar. Let Man take care of his cultivated trees but let Nature take care of the wild cherries.

If I have given you the impression that we know very little about the life of this common insect and its complex relations with other living things, I shall not be disappointed. A realization of ignorance is the beginning of wisdom! As a matter of fact, we know even less about the lives of thousands of other kinds of insects in our neighborhood than we do about the tent caterpillar. The study of insects is still in its infancy. We are still largely in the preliminary but fundamentally important stage of describing and naming the species. One of the greatest needs in biology today is intensive work on the biology of insects. For this work we need field laboratories equipped with capable research men. The search for the "unknown factors" in the biological equations involving human affairs is a matter for pure science, but it is extremely practical as a necessary foundation for applied science—in this case for finding solutions to the problems involving our relations with insects. Until these factors are known, we can have no satisfactory solutions of the problems, and, unless they are found, it may well be that the "insect menace" will become a real one.

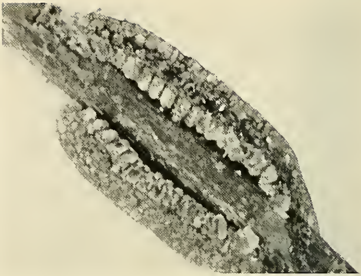


A parasitic wasp—an enemy of caterpillars, a friend of Man

How about the

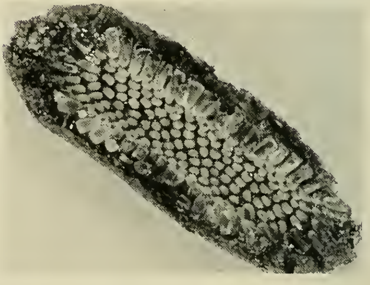


In a peak year. On less than a foot of twig shown above there are eight egg-masses. Under such crowding none of the caterpillars will mature

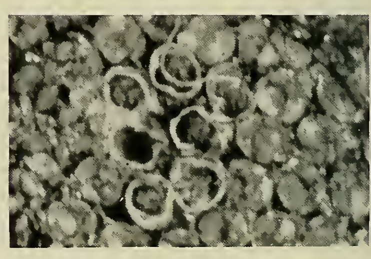


(Above) Each egg-mass is laid in a band around the twig and smeared with a protective sheath (Half of band removed)

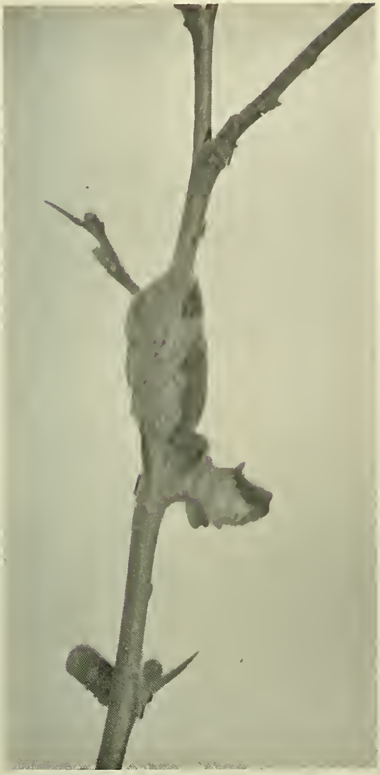
(Below) Here the twig has been removed. (About four times actual size)



(Below) Eggs enlarged about fifteen times. Tops of seven are removed, showing caterpillars in six

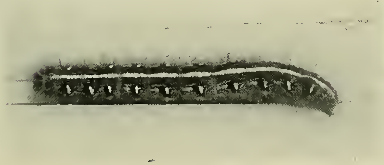


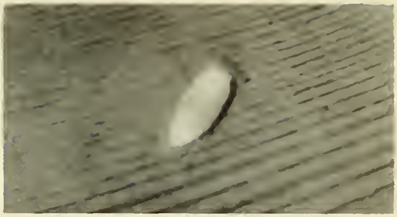
Tent Caterpillar?



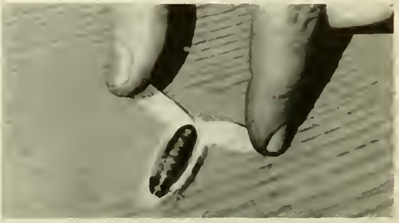
(Above) A group of newly hatched caterpillars on egg-mass

(Below) A fully grown caterpillar

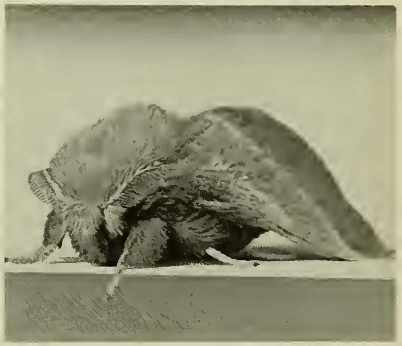




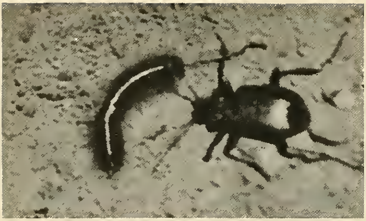
(Above) A silken cocoon spun by a fully grown caterpillar about to pupate



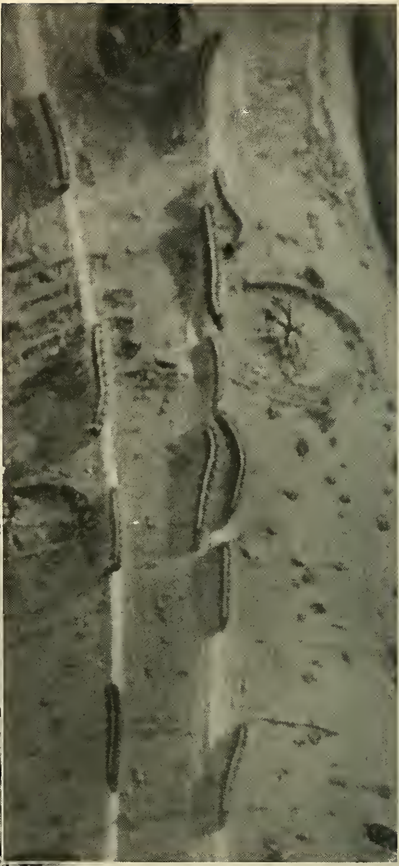
(Above) The same cocoon opened. The larva has molted and become a pupa. The old larval skin may be seen at the lower end of the cocoon



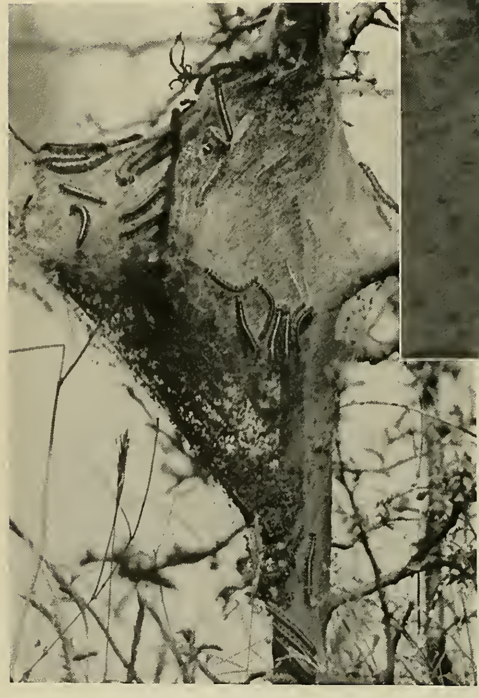
(Above) The adult stage of the tent caterpillar, a brown moth, shown here about four times natural size



Beetles known as caterpillar hunters (Calosoma) are among the caterpillar's natural enemies



(Below) A healthy family of tent caterpillars. A large part of their lives is spent in eating wild cherry leaves and spinning silk



(Above) Tent caterpillars following their silken paths spun between food and rest

Healthy

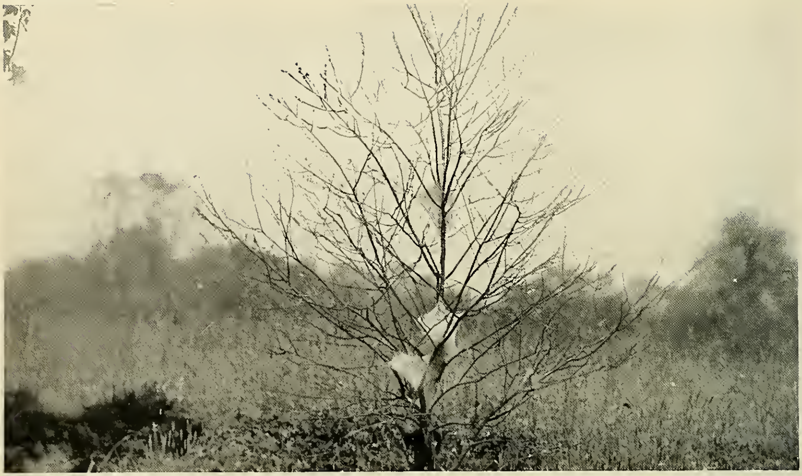
Diseased

Disease has started in the tent caterpillar family shown at the right. The caterpillars have reached their periodic peak and Nature is restoring her "balance"

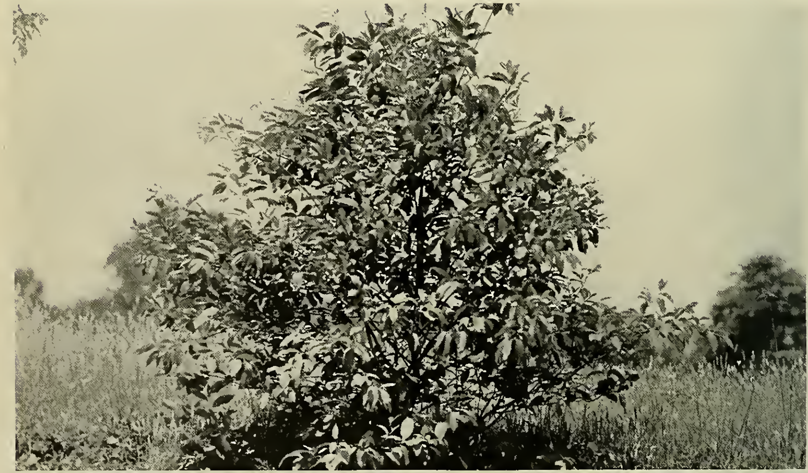
(Below) The family has been exterminated by disease

(Below) A tent caterpillar dying of bacterial disease

Before



After



(Top) A wild cherry defoliated by an over population (three nests) of tent caterpillars
(Bottom) Three weeks later. The caterpillars have starved but the wild cherry has not been injured. "Kill, if you wish, the tent caterpillars on your orchard trees and ornamentals, but let Nature take care of the wild trees, and under no circumstance cut down wild cherries"

Rhineodon at New York's Front Door

The whale shark's farthest north by 335 miles. His capture off Fire Island Light, August 9, 1935

By E. W. GUDGER

Associate Curator of Fishes, American Museum

JUST as I was locking my desk preparatory to leaving my office on Friday, August 9th last, the telephone rang and an excited voice asked if this was the department of fishes in the American Museum. On being answered affirmatively, the voice said:

"We've just brought in to Islip a mighty big shark. Do you want it?"

Not dreaming what marvelous fortune was in store for me, I answered "Not at 5 P. M. after eight hours work on a hot August day."

Indignantly the voice said "This is no ordinary Long Island shark, it's a whale of a fish."

I then asked for its size and the answer came back "thirty-five feet." Whereupon I sat up and took notice.

Just another basking shark?

I knew that in our waters only two sharks reach this great size—the whale shark, *Rhineodon typus*; and the basking shark, *Cetorhinus maximus*. The whale shark, a tropical fish, had never been known to come in any ocean so far north by 335 miles. On the other hand, the basking shark is a cold-water form which on our coast ranges as far south as the North Carolina capes. Hence I thought this Islip fish must be a *Cetorhinus*. Furthermore, since we had obtained and had mounted a thirteen-foot specimen of the basking shark taken on the New Jersey coast a few years ago, I was not particularly interested.

However, to make sure I asked what kind of nose the shark had and was told that it was square cut. A question about the mouth brought the answer that it was at the front end of the square-cut head. My next query was about teeth, and the answer came that they were so small that they could hardly be seen.

Surely not a whale shark!

Was it possible that my informant had a whale shark before him? I queried:

"Did you ever see a Long Island shark that did not have the snout pointed, the mouth underneath the head and filled with large sharp teeth?"

Quick as a flash came the indignant answer: "Man, I'm telling you just what I see as I look out of my window at the head of this giant."

I was now almost convinced but, to establish the identification positively, I asked and was told that there was a median ridge on the center of the back, that there were three ridges on each side and that the lowest ran out on to the tail. Inquiry as to color brought the statement that it was dark with vertical yellow bars and that in the checkerboard squares made by these with the ridges were large yellowish-white spots. This made me absolutely sure of the identity of this great fish.

As wildly excited as the man at the other end of the wire, I shouted "Man alive! you've got a *whale shark*, the only one that ever came so far north not only in the Atlantic Ocean but in any ocean."

As it was now closing time, my colleagues, John T. Nichols (of the department of fishes) and Harry C. Raven (of the department of comparative anatomy) had foregathered in the next office preparatory to leaving for their homes on Long Island. With ears assaulted by the "thunder of the captains and [especially] the shouting," they had come in to see what it was all about, and to suggest that if I would open my window, the man in Islip could probably hear me without the intervention of the telephone. But on hearing the words "whale shark" they too (knowing how rare this fish is) became almost as excited as I was.

The speaker at Islip then asked "Can't you come out and see and identify our fish? We want to exhibit it."

I answered that I did not know where Islip was nor how to get there. Then Nichols said, "Gudger, you must go. You will never again have such a wonderful opportunity to see a whale shark in the flesh. You must not miss this chance." And Raven spoke up—"Come out with me on the train to Baldwin and I will get my car and drive you out to Islip." Whereupon I shouted to the man at the other end of the wire "I'll be out about 7:30 and I'm on my way now. Good-bye!"

After twenty-three years' pursuit

In July, 1912, at Miami, Florida, I had seen hanging over a long pole under a shed, the skin of the thirty-eight-foot specimen of the whale shark, *Rhineodon typus*, taken some weeks earlier at Knight's Key. I had and I have never seen a whale in the flesh, but this skin, big enough to cover a medium-sized whale, was the most enormous that I had ever beheld. Three years later I saw this skin after it had been (poorly) mounted, and then I began to realize the enormous bulk that this largest of sharks attains. But I had to see the fish in the flesh to get an adequate idea of its colossal size, of its mastodonic proportions.

In the twenty-three years since that sight of the skin at Miami, I have hunted *Rhineodon* not in the "seven seas" but in the warm and warm-temperate waters of the three great central oceans—in books and scientific journals and in a world-wide correspondence. As a result of this long drawn out search and correspondence, I was able as of January 1, 1935, to list 76 recorded specimens plus an indefinite number which had been seen but not recorded by scientific men. Of the 76, as a result of the far-flung correspondence and by virtue of my (self-constituted) position as official recorder of the occurrence of the whale shark, I had myself put 32 specimens on record. And in all these twenty-three long years, I had never seen *Rhineodon*.

Four disappointments

Four times I have missed seeing whale sharks in Florida waters and have lost the opportunity to get a skin for the Museum. (1) In May 1912, on my way to the Marine Biological Laboratory of the Carnegie Institution of Washington at Tortugas, last far-flung outlier of the Florida Keys, by being two days too early, I missed the capture at Knight's Key of a 38-foot "sea monster." No one knew then what this great animal was. But as noted above, I saw the skin late in July and identified it as that of the whale shark.

(2) On June 11, 1919, a telegram to the American Museum announced the capture on the previous day of a 31-foot whale shark in the Bay of Florida near Cape Sable. But I was chained to Volume III of the *Bibliography of Fishes* (of which I was editor) and could not go.

(3) On June 9, 1923, a 31.5-foot *Rhineodon* was captured at Marathon, near Long Key, Florida, and next day word of it came to the Museum. Again I could not go. I was just out of hospital and it would have been suicidal to have made the journey and undergone the fatigue necessary to get the skin. However, Mr. L. L. Mowbray, now of the Bermuda Aquarium, was at Miami and went at once to Marathon. Of his heroic but futile efforts to tow the fish to Key West where it could have been skinned, the story has been told in NATURAL HISTORY for March-April, 1930.

(4) On January 18, 1932, an 18-foot specimen was taken in the Gulf Stream off Miami. On the 19th, a telegram came to the Museum which simply read "Huge shark captured here. Do you want it?" This was referred to me, but as all other Florida whale sharks had been taken in summer, I judged that this winter-captured fish was a huge hammerhead (a gigantic specimen of which I had had word at Miami) or else a huge tiger shark whose kind abounds in those parts. A wire of inquiry as to what the fish was was sent but, when the answer came twenty-four hours later, the fish had been disposed of and the skin removed.

What a saga of ill fortune and hard luck! But the tide turned that evening of last August.

The whale shark in the flesh

Raven and I reached Islip about 7:30 P. M. and were directed to the plant of the Sunrise Fish Company. The shipping room had double doors back and front and was about thirty-five feet deep. When I stepped up on the loading platform in front, the mammoth fish lying on the concrete floor seemed to fill the whole room from door to door. The gigantic head and gill parts, looking somewhat like a huge collapsed crate with one end gone, seemed to fill the whole doorway. From this, the huge body, as large as a great oak in a primeval forest, stretched back and back to a vast tail within the spread of which a tall man could stand with room to spare. The whole thing was unbelievably enormous.

For the first time in my life I beheld a whale shark in the flesh, the hugest thing that I ever saw come out of the sea. I looked at it head on, I walked around it, I climbed on its broad head, and I walked down its great back. It was the most enormous, the most colossal, the most gigantic sea animal I had or have ever seen. I am drained dry of adjectives. What is needed is the vocabulary of the advance press agent of a circus.

I have no standards of comparison for this fish. I have caught and dissected 10- and 12-foot hammerhead and tiger sharks at Beaufort, N. C., and at Key West and Tortugas, Florida. These probably weighed 600 to 800 pounds and to get them up on the dock with a derrick and tackle had required the help of all the loafers on the dock. But here was a fish three times as long as any of these and seemingly ten times as big, whose weight must be estimated in tons and which would require a power-operated derrick to lift. I was simply overwhelmed.

When I recovered somewhat from the mental paralysis induced by the shock of seeing this "monster," Raven and I measured it. The details of sizes and structures will be left for a technical paper. But a few of the measurements may be given here sufficient to make clear that the adjectives applied are justified.

The fish measured 31.5 feet in total length. The width of the head over the curve between the eyes was 5 feet. The same measurement over the curve at the first gill-slit was 6 feet 5 inches. The width of the mouth straight across from corner to corner was 44 inches—just 4 inches short of 4 feet.

The teeth forming a broad band in each jaw, were only about one-eighth of an inch high. It was impossible to get girth measurements since the huge fish had flattened immovably on the concrete floor. However, we measured the fins. The breast fin measured 5 feet long in a straight line. The corresponding pelvic fin was 3 feet 9 inches long. The huge dorsal fin was 4 feet long on its base and 2 feet 4 inches high, and the measurement along the curve of its edge from base to tip was 45 inches.

The tail fin was almost as big as the propeller of a steamer: 7 feet 3 inches + along the curve of the upper lobe and 4 feet along that of the lower lobe. The + sign for the measurement of the upper lobe is inserted because some visitor had cut off the tip of the tail and had carried it away as a souvenir. The spread of this gigantic tail fin was 9 feet.

The extraordinary capture

Friday, August 9, 1935, was literally "Fish Day" for the Schaper Brothers who operate the Sunrise Fish Co. of Islip, L. I., for on this day was captured the whale shark, "the most valuable fish we ever caught." Its manner of capture was unique. With one exception all other specimens that have come into the hands of man, have either been left dead on shore by tides and waves, or have been caught with harpoons and have been killed with bullets. This *Rhineodon* (a male) captured himself in a pound net or trap off Fire Island Light on the south shore of Long Island. One other whale shark is reported to have been found in a fish trap—in the Gulf of Siam many years ago.

The Schapers operate a pound net fishery of four pounds or traps off Fire Island and when with their crew they went out early on the morning of August 9 to fish these traps, they had no premonition that this was to be a day of high adventure for them. The weather was moderate, the sea quiet with only a slight swell, and there was hardly any breeze.

They first hauled their three nets to the westward (the Long Island shore trends nearly east and west) and then last of all went to the east to fish No. 1—and as the sequel shows this was fortunate. Thus all unsuspecting what unusual contents it might hold, they ran up to trap No. 1. But for the fact that Fire Island is not wooded, the photograph on page 169 of an ordinary pound net will show what the Schapers saw on this memorable morning.

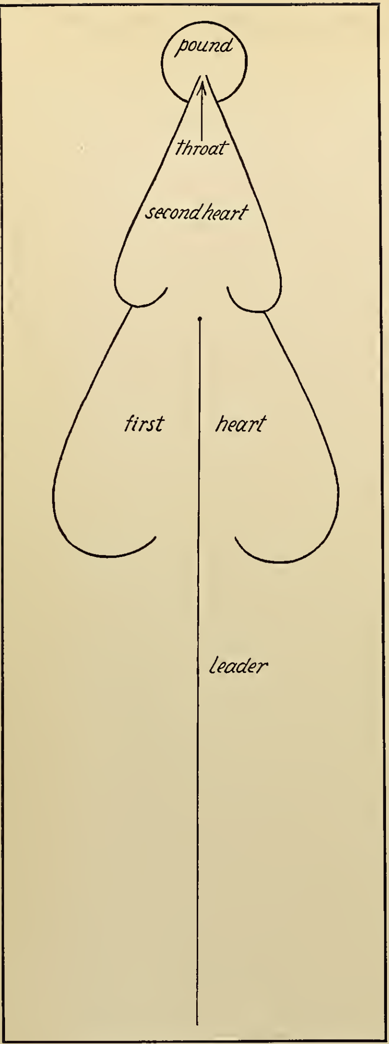
The net that caught the fish

However, the Schapers' pound net is not of the ordinary kind, but is one which is the outgrowth of their experience. Hence it is well here to refer to the drawing on this page and to give a description of their pound net or trap with a brief explanation of how it works.

This huge trap is supported on poles as long as a ship's mast. First there is the 1800-foot "leader" which begins inshore in water 40 feet deep and ends out in water 56 feet deep and everywhere reaches from bottom to surface. This leads into the first "heart," which measures 230 feet around each curve. The first "heart" leads into the smaller second one (195 feet around each curve), and it into the "pound" or pocket. The first heart has at the base on each side of the "lead" openings 60 feet wide and about 50 feet deep, while the "doorway" at the tip is 40 feet wide and 52 feet deep. The second heart opens into the "pound" by a channel which at the base or rear is 15 feet wide by 56 deep, but which narrows to 4 feet wide and 49 feet deep at the front end in the pound. The pocket is a bag 60 feet in diameter and 56 feet deep, suspended on long poles set several feet outside the pocket, so that the net will swing clear of the poles and about two feet above sea bottom. At the tops of the poles are pulleys through which are rove ropes attached to the bottom of the pocket. By these the bottom is brought near the surface so that the captured fish can be easily removed.

Here is how this trap and its parts work. Fishes going east or west along the shore strike the leader and working toward deeper water find their way into the first heart. Their tendency is to still go forward into the second heart and from it into the pocket. The fish seem little inclined to come out through the doorways, but are always nosing against the net. So the whale shark got in and so he behaved.

When, early on August 9, the fishermen reached their net, everything appeared normal, the great fish being invisible. The crew presently began to lift the pocket, working on the "throat" first to close that way of escape for the fishes. When the throat had been hoisted half-way up, the great tail of the huge fish came into view. Arie Schaper from his low (18-foot)



How a Pound Net Works

This diagram illustrates just how the 1800-foot leader guides the fish until they reach the pocket at the other end. This particular pound trap was perfected by the Schaper brothers, who operate a pound net fishery off Fire Island power boat cried out "What is that in the net? It must be a whale." And Richard from the higher pound boat (a 45-foot Seabright dory with a heavy-duty engine) answered "Something enormous! It must be as long as the pound boat." Arie then went aboard the pound boat, got a better look, and said "Let's get this thing ashore, exhibit it and make some money."

Leviathan in the net

Fortunately Nicholas Schaper had brought out this day a power-operated lighter to replace some poles in the leader which had been loosened by heavy tides. This had on it a derrick and block and tackle operated by a gasoline engine. And now Nick was invited to bring his lighter and derrick and "get this whale." The lighter came up and all hands took part in sizing up the situation. When the magnitude of the task was realized, to make sure of the fishes already caught, the pound boat with the merchantable catch was sent off to Islip while the lighter and seven men stayed behind to catch the "whale."

Then came the question as to who would "bell the cat," as to how this great monster was to be captured. Well might the fishermen have asked the questions propounded in the Book of Job and weighed the statements therein.

> Canst thou draw out leviathan with a hook? or . . . with a cord which thou lettest down? Canst thou put a hook in his nose? Wilt thou play with him? . . . or wilt thou bind him? Canst thou fill his skin with barbed iron? or his head with fish spears? He esteemeth iron as straw and brass as rotten wood. The arrow cannot make him flee. Darts are counted as stubble.

However, the hardy fishermen were determined to finish the capture of their prey and get him ashore. And since there was no harpoon on board wherewith to secure the shark, Nick called for volunteers to take one of the 18-foot power skiffs and go into the pocket and get a line around the tail of the animal. Everybody volunteered, and Nick and three other men in their boat entered the net and tackled the whale shark.

The effort to get a line around his tail was futile. The great tail swung back and forth in 15-foot arcs and kept men and boat dodging. Once the fish came up under the boat and lifted it a foot out of water, but it slipped off his broad back. Next *Rhineodon* took up the old shark trick of rolling and twisting. All this time the other men were hard at work raising the pocket, making it shallower and restricting the space in which the shark could maneuver. The weight of the net plus the weight of the huge shark made the tips of the long poles lean inward. This brought the edges of the net (ordinarily about one foot above water) under the water and the shark seemed about to slip over the edge of the net and get away. A bowline noose made of a stout manila rope was lowered in front of the shark as he was endeavoring to get over the edge of the net. When he did come over, the noose was so manipulated that the line slipped over his head, and when line and knot had slipped behind the fish's breast fins, the slack was taken in and the shortened line made fast to a pole. The tired fish being now fairly quiet, another line (technically a "strap") was rove around his tail, and both lines were taken to the lighter and made fast.

A heavy wire from the winch was now rove through the block at the end of the derrick boom and hooked into the "strap." The power was put on and the tail of the whale shark hoisted ten feet above the water. Then the lighter began her journey home, towing the shark tail foremost. But as the water caught the great breast fins, the fish would roll in such fashion that it was feared that the wire would twist in two, so a heavy chain was substituted. Once inside the Fire Island Inlet, it was decided that faster progress must be made if they were ever to get home. So a looped wire was put around the fish and it was lifted on board the lighter and secured. And so into Islip, seven miles away. The fish was first seen at 9:30 A. M., the start made about 12:30, and Islip was reached at 4 P. M.

On shore at last

The lighter was tied alongside the dock and the fish unloaded by means of the derrick and winch. Boards were then laid into the back door of the fish house. A Mack truck was backed up to the front door and harnessed to the whale shark. Slowly with much puffing and backfiring the truck dragged *Rhineodon* up on to the concrete floor where I found him as described above.

This whale shark, like all others for whose capture there is any data, at no time put up any fight. At no time did it attempt to bore through the net as a basking shark had recently done when caught in the same trap. It contented itself with rolling and twisting. Had it exerted its great strength, it surely would have torn its way out or maybe would have carried part of the net with it. This is undoubtedly the most unique capture on record of a whale shark, for the Siamese fish referred to above was not captured but died in the trap.

The most northerly record

The whale shark is a tropical fish which rarely departs from its normal habitat and then ordinarily only for a comparatively short distance in a friendly warm ocean current. It is such a rare fish that its capture is in the way of being an event at any time. And when one is taken 1180 statute miles from the tropics and almost at Father Knickerbocker's front doorstep, and when this great fish catches itself in a trap, it is an occurrence so unusual as to call for its recording.

Until this specimen was caught its "farthest north" was in the Pacific Ocean at Cape Inubo, just east of Tokyo, on the great Japanese island Hondo, in latitude 35° 39′ North. Its most southerly station is off the southern end of Africa in Table Bay near the Cape of Good Hope—latitude 33° 55′ South. Thus its northern limit is about 2452 statute miles from the equator, its southern range about 2333 miles from base line. These extremes are far outside the tropics in both cases: 837 miles at Cape Inubo, and 717 miles at Table Bay.

The explanation is essentially the same in both cases. The whale shark is relatively abundant in the Philippines and has been carried from these waters to Cape Inubo by the Kuro Siwo or Japan Current. *Rhineodon* has been known for 65 years to be not uncommon in the western Indian Ocean, around the Seychelles Islands. Thence it is carried south to the Cape by the warm Agulhas Current and its components. So the first specimen (15 feet long) ever recorded was carried to the Cape in 1828 the year of its first discovery. And so was brought the last specimen (20 feet "over all") taken in those waters—in 1934.

In the Atlantic Ocean, eight specimens (the last in the year 1936) have been recorded from what may properly be called the Straits of Florida region. The most northerly of these was an 18-foot specimen which came ashore in 1902 at Ormond Beach in about 29° North Latitude. This record stood for 32 years until one was stranded in June, 1934, on the southern side of the mouth of the Cape Fear River, in about the latitude of Cape Fear, N. C. (34° N.) some 325 miles north of Ormond Beach. This new northern record for the Atlantic is surely to be credited to the help of the Gulf Stream.

And now comes the capture by the Schaper Brothers of a 31.5-foot whale shark off Fire Island Light-house, Long Island, in latitude 40° 38′ North—the most northerly record not only for the Atlantic Ocean but for the world. This isolated individual, undoubtedly carried hither by the Gulf Stream, had strayed far from its tropical habitat—2786 miles from the equator and 1180 from the Tropic of Cancer, and about 450 miles farther north than the specimen recorded from the mouth of the Cape Fear River. Furthermore the Fire Island fish breaks by 335 miles the northernmost record previously held by the Cape Inubo rhineodons, and by these 335 miles it sets a new record for the greatest distance from equator and tropic.

This specimen, moreover, has another distinction—it is the eightieth *Rhineodon* on record as will now be shown. It may interest the reader to know that as of January 1, 1935, I had listed 76[1] whale sharks definitely recorded from the three central oceans. Since then I have recorded a new capture (the sixth) at Acapulco, Mexico, and another (the third) from Havana, Cuba. Then Brimley has listed the specimen (referred to above) from near Cape Fear, N. C. These make 79 records of the occurrence of *Rhineodon typus*. That from Fire Island Light is No. 80 for the whole world.

The fate of this whale shark

The captors and owners of the whale shark, Messrs. Arie, Nicholas and Richard Schaper, showed the finest possible spirit of coöperation with Raven and myself as representatives of the American Museum and told us on Friday that ultimately we might have any parts of the fish that we desired. However, they wished to exhibit the fish on the Saturday and Sunday following and thus recoup themselves for the expense to which they had been subject in capturing the great shark and bringing it in to the fish house. They then said that by Monday afternoon or Tuesday morning the fish might be expected to be in such condition that it could no longer be exhibited and that we could then have what parts we wished.

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[1] Proceedings Zoological Society of London (for 1934), 1935, p. 882.

Now it had happened some four months before this that a member of the American Museum, Mr. Charles T. Wilson of New York, had presented to the Museum the skin of an 18-foot whale shark taken at Acapulco, Mexico, and that this skin was in process of preparation for mounting. Here then was an embarrassment of riches. However, even if we could have had the skin of this giant, we had in our restricted exhibition space in the Museum no room for a 31.5-foot specimen. Hence we reluctantly asked for the head and gill-arches, for the eye, the heart and certain of the hard parts of the skeleton for the department of comparative anatomy in the Museum. These with great good will were promised to us, and in return Raven gave helpful advice about the use of ice and other preservatives to keep the mastodonic shark in condition for two days' exhibition. He and I then came away with promises to return on Monday.

A stream of visitors

On Friday, while Raven and I were examining the shark, making measurements and notes, a constant stream of visitors was passing through the fish house. The New York papers on Saturday morning (August 10) carried pictures of the great shark, and the enterprising fishermen sent out hundreds of handbills. As a result there was on Saturday and Sunday a great and constant stream of visitors to see the whale shark, and the small admission fee charged brought in a large aggregate return to the Schapers. Among the visitors was Mr. W. K. Vanderbilt, who was so much struck with the great fish that he negotiated for the skin on the shark, this to be removed at his expense.

On Monday, August 12, Raven went to Islip about 11 A. M. and found a smaller but constant stream of visitors still viewing the prize of the Schaper Brothers. He was told that Mr. Thomas Rowland, the well-known taxidermist of New York City, representing Mr. Vanderbilt, would that afternoon begin to remove the skin, and that about noon the next day we could get the parts we desired. These matters Raven communicated to me by telephone, and I at once requisitioned for a Museum truck for early next morning.

August 13, a lucky day

On Tuesday, August 13 (a lucky day for us), Raven was early on the scene and early telephoned to me that *Rhineodon* had been dragged out on to the lighter and that the skinning had been begun the day before, that it was progressing satisfactorily, and that I should bring the truck out about noon. About that hour I reached the scene of activity and found that Mr. Rowland and his men had got the skin from the body up to the gill and head parts. The removal of the exceedingly thick skin offered many difficulties, and trebly so in the gill and head region and it was not until about 3 P. M. that the skin was free from the whole body and the Brobdingnagian task ended.

Since the rubber-like skin was about 4 inches thick, and was 25 feet long (to base of tail fin) and about 15 feet in full breadth, its stiffness and weight made its removal a problem. Indeed, the skinning was made possible only by dragging the fish out on the dock and lifting it on to the lighter above referred to with a block and tackle from the yard-arm of the mast, the power being supplied by a gasoline engine. A line was then looped around the tail portion of the skin and as fast as it was cut free from the flesh (one cannot husk the hide off a shark as one can from an ox), it was lifted up so that the skinners could advance farther headward.

Finally about 3 P. M. the skin was freed from the head, and Raven went into action. With an axe he cut off the head and by means of the derrick we loaded this on the Museum truck. He next got an eye, some of the gill-arches, the heart, and a section of the curious tubercle-lined oesophagus. The fish being a male we were unfortunately debarred any opportunity of deciding whether the whale shark voids its eggs out in the sea water or whether it brings forth its young alive as most of its kind do and as there is fair reason to believe *Rhineodon* does.

As for the other viscera, they were too mastodonic for anything to be done with them. For instance the left lobe of the liver was 9 feet long and as large around as a man's body. Let the reader look at a 6-foot man standing against a wall, let him mark off 3 feet (half the man's height) on the wall above his head, and he will have the length of the liver—9 feet, the height of the average ceiling of the ordinary house. We might have brought in the 10- or 12-foot long spiral-valved large intestine but we had no container to put it in and our truck was loaded.

Back to the deep

With the skin removed, there remained the matter of disposing of the carcass. Frank Buck (of *Bring 'Em Back Alive* fame) wished to purchase it to feed to the carnivorous animals at his Long Island station, but was deterred on finding that some formaldehyde had been poured on the skin as a preservative. So the Schapers had to carry the carcass out to sea, attach heavy weights and sink it.

What we all got

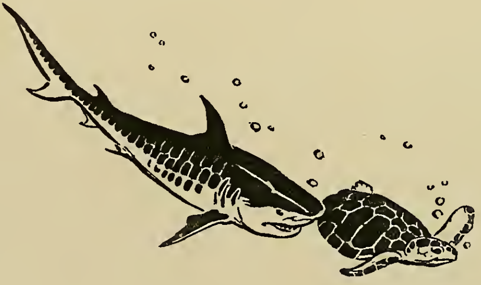
The fishermen got a large return from exhibiting "the most valuable fish we ever caught."

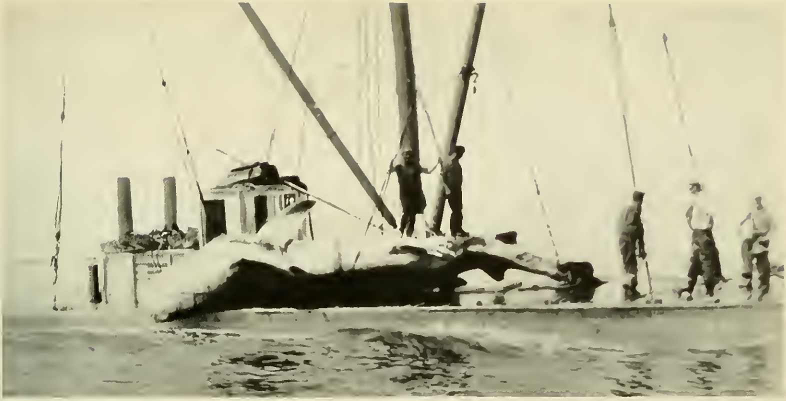
Mr. Vanderbilt got the skin of a full-grown whale shark for mounting and display in his museum at Northport, Long Island.

The American Museum got the skull and other precious material for future study.

The sharks and other fishes, and the crabs out in the ocean got a great feast that lasted for days.

And the writer (after twenty-three years' search) got a vivid memory of a whale shark seen in the flesh.

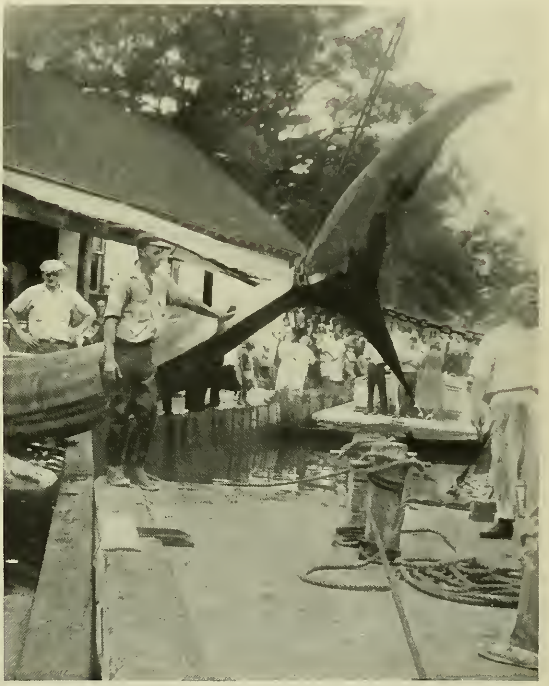




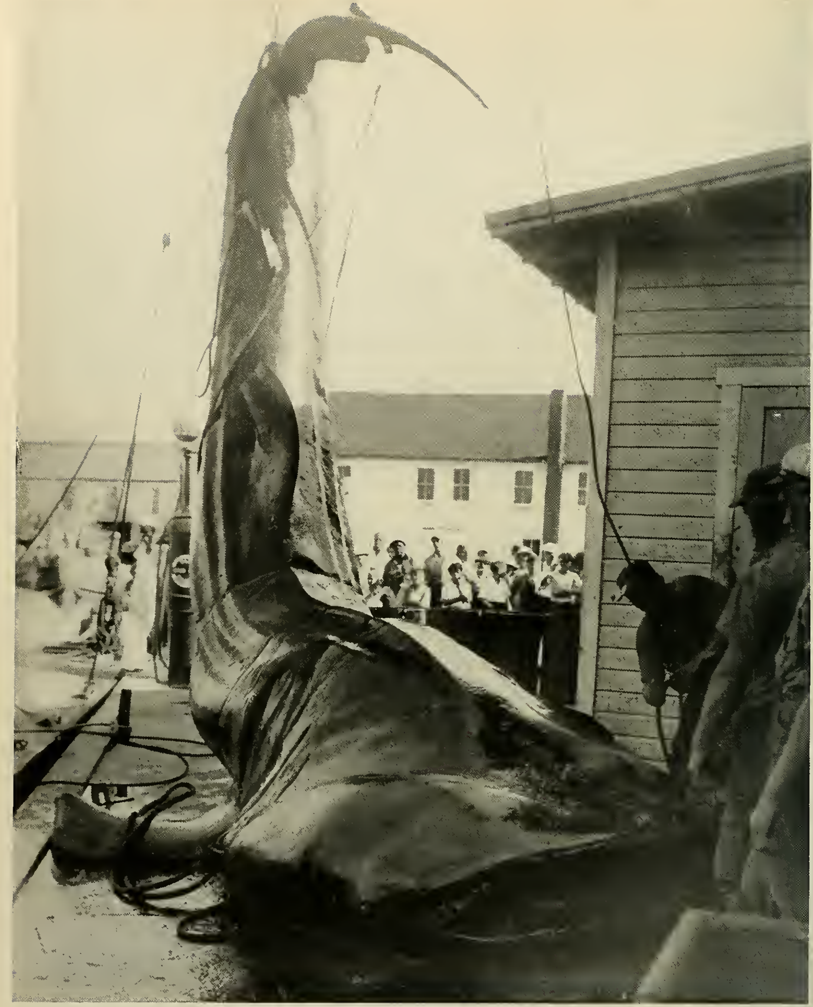
Rhineodon at New York's Front Door

(Above) Bringing in the prize. As soon as the lighter was inside Fire Island Inlet, the whale shark was lifted aboard by means of a wire looped around its body; the boat then made good speed to Islip

THE PHOTOGRAPHS USED IN THIS SERIES WERE PRESENTED TO THE AUTHOR BY THE SCHAPER BROTHERS, WHO CAPTURED THE GREAT FISH



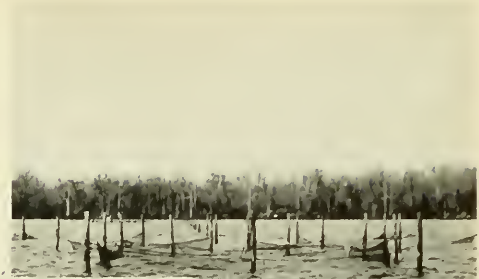
(Right) The gigantic tail fin had a spread of nine feet. Along the curve of the upper lobe it measured seven feet, three inches plus, and four feet along the lower lobe. The tip of the upper lobe had been snipped off by a souvenir hunter

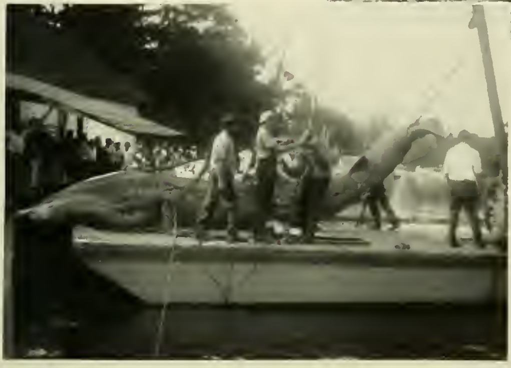


Up from the Sea

Derrick and winch were used to unload the whale shark on to the dock. An admiring throng stood by and gaped as the huge dimensions of the fish were fully revealed to their astonished gaze. Note the wide mouth and on the body the three ridges

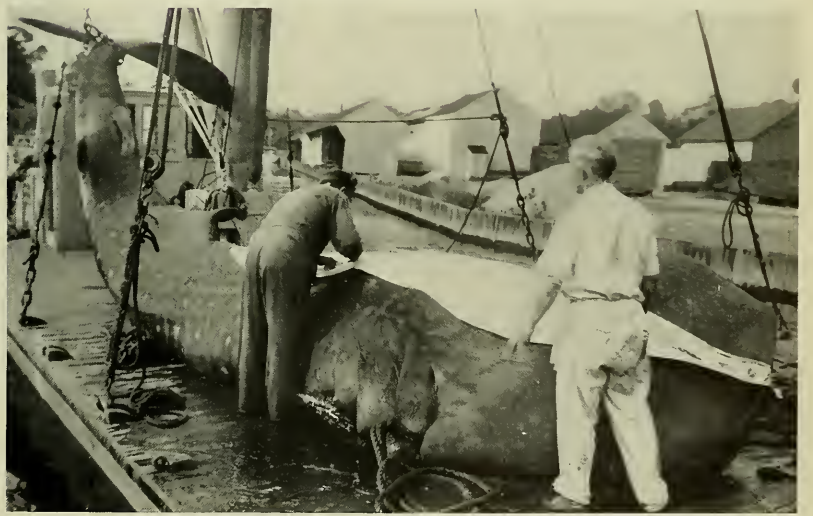
At the right is a pound net as seen from above the surface of the water. This photograph is reproduced by courtesy of the U. S. Bureau of Fisheries

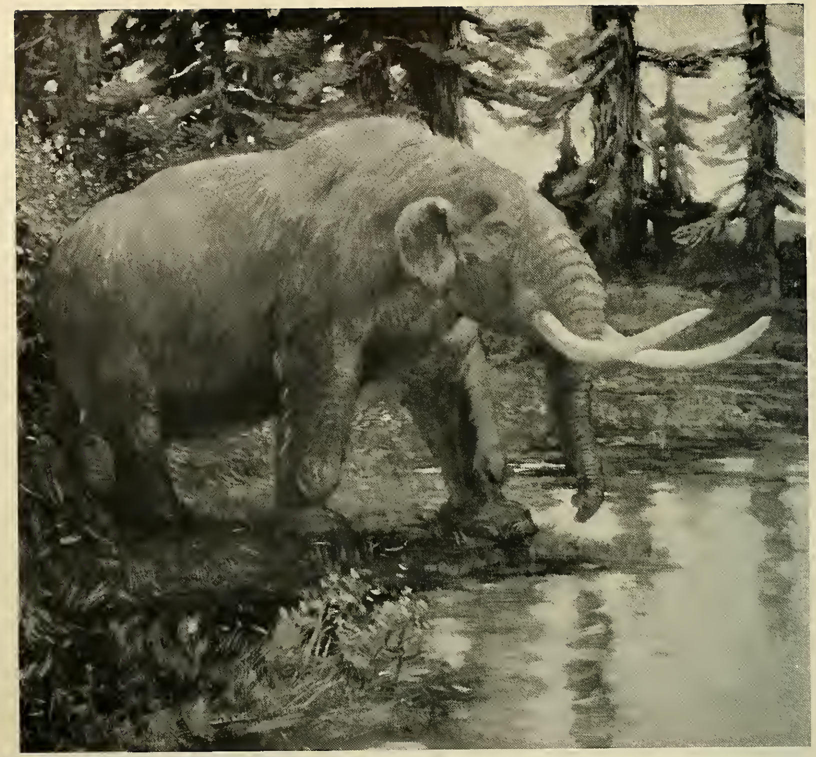




(Left) Here the carcass of the whale shark is being dragged on to the lighter preparatory to skinning.

In the picture below, the skinning is under way and is progressing satisfactorily despite the many difficulties presented by the exceeding thickness of the hide

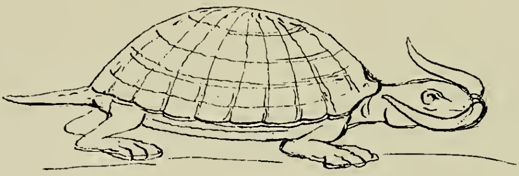




© by the American Museum. Painted by C. R. Knight under the direction of Henry Fairfield Osborn

THE MASTODON AS IT REALLY WAS

Mastodon americanus *as it appears in the restoration painted by Charles R. Knight (above) is an amazing contrast to the Pedder interpretation shown below. (Below) James Pedder's restoration of the "Missourium," 1841. Impossible as it may seem, this restoration was based on bones of a mastodon. The mustache-like "horns" are the tusks, and the legs have been folded down to make them look like those of a tortoise. The shell is wholly imaginary. This copy of Pedder's sketch was made by the English anatomist William Clift*



Misconstructing a Mastodon

When misguided imagination was applied to some of the first mastodon bones ever found, an amusing freak of nature was created

By GEORGE GAYLORD SIMPSON
Associate Curator of Vertebrate Palæontology, American Museum

ALMOST everyone now knows what a mastodon looked like, thanks to the numerous skeletons mounted in museums and the many careful paintings and drawings made by artists under the direction of capable scientists. We know that it appeared very much like an elephant, differing only in some details of proportion, such as its relatively longer body and shorter legs. Now that this knowledge has been acquired, it is hard to conceive of the great difficulty that earlier workers had in interpreting the more scanty remains known to them and to realize that even intelligent and learned men at first did not see the resemblance to elephants. Even elephants were half-mythical beasts to many of them, and few Americans or Europeans had then seen one in the flesh.

Early "discoveries"

One of the earliest attempts to restore a mastodon is contained in some papers which Mr. C. D. Sherborn of London generously gave to me a few years ago for preservation in America. These papers are so amusing and so valuable for the sidelight that they cast on early discoveries of mastodons and on the history of science in America, that their most interesting passages are here published.

One of the first mastodon skeletons to be discovered, and the one referred to in these papers, was found by one Albert Koch in 1838 in Gasconade County, Missouri. Not recognizing its true nature, Koch dubbed his fossil skeleton "the great Missourium." He set up the bones after a fashion and exhibited them in America and later in London. During the London exhibition, the *London Times* for December 31, 1841, published the following notice of the beast:

> THE MISSOURI LEVIATHAN
>
> We are not disposed to place the most explicit confidence in anything that comes from our American friends. They deal too much in the marvelous, and, speculating on the good-natured credulity of the English, they often narrate to us strange stories, and exhibit for our amusement still stranger animals. A person by the name of Koch has recently imported from America the fossil remains of a gigantic animal between whose legs, it is said, the mammoth . . . . may have strutted with ease . . . .
>
> The animal is supposed to be aquatic in its nature. This we should have inferred from the anatomical structure of its neck.

While the specimen was still in America, it had been seen by a worthy Philadelphian, Mr. James Pedder, the editor of *The Farmer's Cabinet and American Herd Book.* This gentleman had an original turn of mind, and he soon concluded that current ideas of the "Missourium" were very erroneous, and felt it his duty to correct them. He therefore wrote to the man most qualified to judge the matter, Prof. (later Sir) Richard Owen, at that time the ablest anatomist in England. His letter, dated November 20, 1841, included the following passages:

> May I trouble you on a subject, which, however, I presume you will feel interest in. By this time the Bones of the Missourium are arrived amongst you:— they have made much noise in this part of the world, for there has been considerable "shaking amongst them, which is not yet entirely stilled . . . . I have taken up the Idea that the Animal was of the Tor-

toise Tribe, and is therefore, improperly erected in its present shape . . . . And first, I would call your attention, particularly, to the bones of the Elbow-joint, and say, if the leg were to be carried out so as to form a junction . . . . whether the feet would not be spread out so as to bring the breast down to the ground? Then again the *front* of the bone of the arm at the Elbow-joint shews, by its smoothness caused by friction, that it must always have been carried in a bent or angular position, like the fore-leg of the Tortoise.

To publicize his opinion still more widely and to be sure of its receiving proper consideration from the British savants, Mr. Pedder also wrote on the same day to Petty Vaughan, Esq., of London, enclosing a detailed argument to be read by Mr. Vaughan to some scientific association. Not being very clear as to what association might have authority, Pedder seems to have left a blank in the last paragraph to be filled in by Vaughan as seemed best. The most interesting of Pedder's arguments were as follows:

THE MISSOURIUM

After minute investigation, and repeated opportunity for examination of the Skeleton of the Missourium, I have been led to conclude that the animal was a Monster of the Tortoise Tribe 32 feet long and correspondent width, with the power of withdrawing its head within its shell; the tusks then forming a mail of defense around its edge to ward off obstruction . . . .

3rd. The order of the Neck-bones; the longer placed first, giving the power of withdrawing the head suddenly, and at a jerk, as it were.

4th. The Ribs, so small, short, and widely spread, with so little curve, and withall so weak, and placed edgewise to the body or *half reversed*, by no means calculated to give strength and support to a four-footed animal, 15 feet in height . . . .

6th. The short and flat tail: That of the Tortoise likewise . . . .

8th. The feet armed with Claws. Those of the Tortoise also:—too weak and small in their articulations for the support of the body; the weight of whose bones is near 3000 lbs—Their position also, being like those of the Tortoise, turned outwards; and in all probability, partially webbed . . . .

12th. The size of the Teeth, to appearance much too small for an animal as he appeared on exhibition . . . .

15th. With this view, the difficulty which has been felt with regard to the position of the Tusks, more properly *Horns*, is done away; they always having been carried near the Earth, and resting upon it, at the will of the animal . . . .

17th. In the Ancient Asiatic Mythology, the Earth is supposed to rest on the back of an enormous Tortoise—from whence came the Idea, if not from a knowledge or hearsay of an Animal of the monstrous proportions here exhibited? . . . .

In accordance with these Views the inclosed Drawing has been made, and is submitted to the Examination and Consideration of the
with deference and respect by

Their obedient Servant
JAMES PEDDER

With this communication Mr. Pedder sent a sketch showing his idea of the tortoise-mastodon, which is here reproduced.

It now hardly needs to be pointed out that Pedder's argument and restoration are wrong in every detail, although all his mistakes were natural enough in that day when so little was known of prehistoric animals. Even at that time, however, the more progressive English anatomists were well able to see the absurdity of Pedder's views.

The preservation of these notes is due to William Clift, who copied them carefully and filed them away. He was at that time Conservator of the Museum of the Royal College of Surgeons, and was Professor Owen's father-in-law. On his notes Clift had added a satyrical comment which is an appropriate last word on the subject:

Can it be possible that Jonathan Pedder has racked his brains, and wasted his Time, (and Time means Dollars in America) in concocting this beautiful and philosophical view of his subject, in sober sadness? or does he imagine that his friend and father John Bull's gullet and gullibility are so capacious and accomodating as to *swallow* the World, the Elephant and the Tortoise? by way of opening a passage for receiving fifty miles, or so, of Sea-Sarpent?

The later history of these bones must have annoyed Mr. Pedder greatly. His suggestions were discarded with no more attention than they deserved. Owen examined the skeleton as exhibited by Koch, identified it as being a mastodon and of the elephant tribe, and pointed out many errors made by Koch, who, nevertheless, was much nearer the truth than our compatriot Pedder. Later the British Museum acquired the specimen. Completely and carefully reassembled, it still stands in a gallery of the natural history division of that great institution.

Eskimo Dogs—Forgotten Heroes

Showing the intelligence, loyalty, and strength of the Eskimo dog, and the thrills and hardships of dog-driving in the far North

By W. Elmer Ekblaw

The day of the dog sledge in Arctic exploration seems to be past. That century or more of courageous travel over ice field and glacier which closed with the introduction of the airplane to polar research, constituted a period of brilliant exploit and daring survey of new land that remains unparalleled for hazard, for hardship, and for human perseverance. It was a period of romantic research that pushed back toward the poles the Arctic frontier until there was no "farther north."

A passing mode of travel

The sacrifices, the service, the noble deeds that characterized that period will continue to inspire and challenge youth and manhood until the last record of that glorious past is lost. The lure of the Arctic trail, the mystery of the midnight sun, the majesty of the aurora borealis will ever remain, but that most thrilling phase of polar activity, sledging with dogs over snow field and sea ice, which added so much to the fascination of Arctic exploration in the century past, cannot persist as a means of transport for seeking out new lands, new seas, in competition with the airplane. For the airplane can cover as much territory in a day as the dog sledge can in a whole season.

Yet the passing of the dog sledge marks the end of one of the most delightful, most impelling elements in the lure of the Arctic. Many things will always make the Arctic glorious and attractive: the freedom from petty responsibilities of civilization; the pure air; the healthful food; the freedom from illness and epidemic diseases; the invigorating activity of the chase by land and sea; the majesty of the landscape; and the sublimity of colorful skies. But the exultation of dashing over new ice, of hearing the rhythmic beat of furred paws and the vibrant ring of steel runners upon frost-felted ice, and of seeing the mirage ever painting new pictures upon the horizon, was lost when dog-driving in exploration ended.

The peoples resident within the polar realms, however, they who make their homes along the desolate Arctic shores, and wrest their living from the niggardly north, must ever cling to the dog, the dog sledge, and dog-driving for getting about on their broad hunting and fishing grounds. They depend upon the dog as their only draft animal, their only means of getting from village to village, from one habitat of game to another, or from the haunts of one kind of game to the feeding grounds of some other kind.

The Eskimo's chief asset

Among the Polar Eskimo of Thule, or Northwestern Greenland, most dependent of all upon their dogs, there is no such thing as wealth, no system of land tenure, of property, or of possession except of a few personal belongings, but prosperity and welfare may be measured in terms of dogs. If a hunter have an adequate number of dogs in good condition, he can sledge far to the haunts of game, wherever they may be, and having made his kill, haul home on his sledge a heavy booty of meat for food, blubber to light and heat his igloo, and skins or furs for clothing his family. His folk are well fed, happy, and healthy; they are dressed warmly and comfortably; their igloo is well lighted and well heated. He is prosperous, a good hunter. His dogs remain strong and powerful.

On the other hand, if his dogs be so few or so under-nourished as to be inadequate, either through accident or disease, then the Eskimo, no matter how energetic and skillful a hunter he may be, is doomed to poverty until he can rebuild his dog team to sufficiency. While his dogs are few or weak, he cannot travel far, and must confine his hunting to grounds where game is scarce or hard to kill because of over-hunting. When he makes a kill, he cannot overload his sledge because his weakened dogs cannot pull it. His family suffers want—his wife and children and other dependents are undernourished, their clothing becomes worn and depleted, and his igloo remains cold and gloomy because of lack of blubber for heat and light. His dogs remain half-starved. He is poverty-stricken.

Thus the dog team rigorously determines the economic status of the Polar Eskimo. The resources of his land are sparse and monotonous. He must live by game alone, for meat is his only food, skins and furs are his only clothing, blubber is his only fuel and source of light. He must hunt. He cannot farm, he cannot trade. He cannot engage in the hundred and one businesses of the Southland. He has no grass to feed cattle or sheep or horses, no grain for hogs or poultry.

Supreme in the Arctic

Camels or llamas could not endure such a land as Thule. Cattle of any variety, horses and their kind, and even reindeer, would be of no use on glare sea ice. They could find no footing, and thin ice would not bear their weight. They could not eat fish or flesh. They could not survive without frequent feeding. Even the best of them are not so obedient, so tractable, so sensible, so companionable, and in many ways so self-sufficient, as is the dog. The Arctic decrees that the Eskimo may have no other draft animal than his dog.

For the Eskimo dog is a marvelous adaptation to Far Arctic conditions of terrain and food supply. He is light enough to travel over ice so thin that even man may not venture upon it, and yet he is strong enough to pull a heavy burden by sledge. He lives by flesh alone, the only food available in the Arctic, and because of his wonderful reserve strength, he can go without food for several days and yet draw the sledge to which he is hitched. He wears a heavy coat of warm hair, warm enough and heavy enough to keep him active and comfortable at temperatures of fifty or more degrees below zero; as long as he is fed regularly about once every three days he can endure the most bitter cold—in fact, revels in it—for weeks on the hardest kind of trail.

Best of all he is intelligent enough to turn every advantage to his own good. He has sense enough to coöperate with his driver in every way that he can. He makes the most of every opportunity for comfort, or rest, or food, whenever it appears. He is loyal, and affectionate, and gentle, happiest when in the harness and on the arduous hunting trail. Though he quarrels constantly and interminably with his fellows in the team, the quarrel is a semi-friendly rivalry, and he never seriously injures his team mates; when occasion arises he pulls together with them as a unit.

Eskimo dogs differ

The dog of the Polar Eskimo is not a true husky. The pure strain of dog which the Polar Eskimo possessed when Parry first encountered them has since been crossed with strains brought into the land by whalers and explorers, and particularly by Peary, who introduced the Newfoundland dog with the deliberate and expressed intent of increasing the size and strength of the Eskimo dog, and accentuating his aptitude for the water environment upon which so much of the driving is done. The resultant breed is a powerful issue of the two strains. Whenever the *singarnok*, as the Eskimo call the dog whose marking and characteristics are typical of the old original strain, appears in a litter, his size and strength are appreciably increased over those of his primitive ancestors, and he is a better dog.

The outstanding attributes of the dog of Thule, the dog of the Polar Eskimo, are his devotion to his driver or master, and his gentleness as compared with the dogs of the Labrador, the Hudson Bay region, and even with the native Alaskan and Aleutian dogs. Very rarely does a Polar Eskimo dog bite or attack any person, or attempt to do so. Much as he quarrels and struggles among his fellows, the dog rarely or never sets upon either children or adults. He dies of starvation and overstrain in the harness, lapping the hand of the driver who is suffering with him and who must desert him when there is no other course. His driver is his God, and he knows no other.

Maximum efficiency in the team seems to be achieved with eight or ten dogs. Fewer dogs reduce the strength of the team more than proportionally, whereas a larger number of dogs demands more time for hunting to provide sufficient food to keep them in health and fine fettle. The best balance between dogs, efficiency, and food seems to limit the team to eight or ten.

"The king dog"

In every team one superior dog, superior because of strength, intelligence, and fighting ability, establishes his right to supreme authority over the rest of the dogs, and thus becomes "the king dog," by soundly and indisputably trouncing every other male dog in the team. Having once established this authority, he maintains it by going through the team periodically, not over a period of weeks but several times a day, and reasserting his sovereignty by forcing every male dog to turn over on his back and subject himself to the king dog's punishment. The king dog knows no allegiance, no obligation to any but his master, or driver, and to his liege master he is leal and true to the death.

Arrogating to himself the responsibilities as well as the prerogatives of authority and leadership, the king dog maintains order and discipline in the team, and as far as he can interpret them, carries out the wishes and commands of his driver. When a king dog has served long under one driver, he becomes uncannily wise in the ways of the trail and the game, and in anticipating the wishes and purposes of his master. Little driving is necessary on the part of an Eskimo who is blessed with a skillful and intelligent king dog. The king dog keeps the team going.

Among the Polar Eskimo the dogs in a team are driven fan-fashion, that is, with an individual trace back to the sledge from every dog in the team. The traces are of the same length or nearly so, sixteen or eighteen feet long, so that the dogs form a semicircle before the sledge as they pull the sledge forward. The traces are of thong of bearded seal or, when occasion requires, of walrus skin, cut to a surprisingly uniform thickness of about three-eighths or one-half an inch.

Such a system of driving is necessitated by the rough sea ice of the Thule coast, over which by far the greater part of the driving is done, whether on the fixed icefoot along the shore, or on the broad expanses of the open sea. If the dogs were driven tandem, either singly or in pairs, stretched out in a line of greater or lesser length before the sledge, some of the dogs would be crushed down over a hummock, or swung up over a hollow as the case might be, and the whole team would be stopped. By the Greenland fan-fashion of hitching, each dog picks his own trail, and though a dog or two might be temporarily held up by the traces catching on a block of ice, the rest of the team would keep the sledge moving.

The disadvantages of the fan-fashion hitching are that the dogs on the wings of the team cannot pull forward with their maximum power, and some of their strength is lost; and despite all the efforts of the driver, and with all the skillful and willing coöperation of the king dog, the dogs do weave in and out somewhat among the traces, the traces become tangled, and the sledge must be delayed until the driver succeeds in untangling them. The period of delay is never wholly lost, however, for on salt sea ice, which is never quite dry, the dogs must be permitted occasional opportunity, every hour or two, to bite out from between their paws the balls of packed ice which form there, and, if left, spread the toes so wide as to break the skin, and more or less seriously lame the dogs.

Guiding the team

The driver uses a long whip, many feet in length, with a handle not over one and one-half to two feet long, and with a lash about half an inch thick at its attachment to the handle and tapering down well nigh to wrapping cord thickness at the last yard or two—the cracker. The lash is skillfully cut and prepared from the finest tanned skin of the bearded seal, and the fine cracker thong is as smooth and uniformly thin as the best braided textile cord. In windy weather, or with a poorly disciplined team, when the whip must be used rather constantly, the cracker snaps off, a foot or more with each lash of the whip, and must be frequently replaced.

"Huk, Huk," and cracking the whip over the dogs is the signal for starting the dogs. The team is turned to the right by calling "Atchook, Atchook" and cracking the whip to the left. It is turned to the left by calling "Howie, Howie" and cracking the whip to the right. It is stopped by an indrawn whistle and cracking the whip before the dogs—they do not always stop, when a bear or seal is in scent!

An ingenious arrangement of strips of ringed seal skin, generally with the hair left on, forms the harness. A band passes about the dog's neck and from that band strips run over his back, and between his front legs and up along his sides to the place where the trace is attached. The dogs never chafe from this harness, and seem never to be choked or in any wise affected by the band about the neck. The harness must be kept fairly soft and pliable and lasts many months. Because, when dog feed is scarce, the dogs sometimes chew their harnesses and traces, a supply of thong and skin for repairs must be carried on long trips where the finding and killing of seal is uncertain.

The sledge

Before the white man came to Thule, the Polar Eskimo made his sledge of bone and ivory because he had nothing else to employ for it. Necessarily then his sledge was small and primitive and three or four dogs sufficed to draw it. The prosperity of the Eskimo then was strictly limited by the tiny size of his sledge, and his standard of living was correspondingly lower. When the white man brought lumber for runners and iron or steel for shoes on the runners, the sledges quickly became larger. Today they are from six to eight or ten feet in length, two or more feet wide, and capable of bearing large loads. Heavily laden sledges require more dogs, but they permit longer hunting trips and larger loads of the necessities of life. Consequently, the standard of living has been much improved.

The enlargement of the sledges and the increase in the number of dogs in the team has not, however, resulted in commensurate advance in the standard of living. The extra time and effort required to kill additional game to feed the dogs imposes upon the Eskimo a regime of hunting that occupies almost every moment of every day when weather and ice are favorable for hunting. The need and capacity of the Eskimo dog for food are well known, and the hunter may not neglect any opportunity for making a kill. Much of the supply of dog-food comes from walrus. Seal hunting supplies a secondary supply of dog-meat; while only relatively insignificant stores of dog-food are obtained by the chase of the bear, the caribou, and the smaller creatures.

On the trail in terrain where game is abundant the Polar Eskimo makes a kill and feeds his dogs about every third day. If the quantity of meat from each kill is sufficient, the dogs thrive on such a program, but when game is scarce, they soon show the effects of overtravel on insufficient nourishment. In country with little or no game the Eskimo carries a supply of slabs of frozen walrus meat, the dog-food *par excellence* for the early spring trail over long distances.

Frozen food

The frozen meat is chopped into pieces about as large as a man's fist, and fed to the dogs frozen solid. The dogs gulp it down, as they do all their food, with little or no chewing. When the feeding is over, the projecting corners of every frozen lump can be felt through the skin over the dog's stomach, and the dog lies and shivers for an hour or more until the meat is thawed out and begins to digest. It seems like hard, cruel fare, but the dogs remain healthy and retain their strength best upon such a diet.

The season of sledging ends when the ice becomes rotten and unsafe. During the summer, when the hunters are out on the open sea hunting the much desired walrus, the dogs wander about the tupiks, or sealskin tents, seeking such waste food as the Eskimo cast away. Only occasionally are they fed. They need little food then, for the sun is warm, and they have no work to do. They laze about the sun-warmed rocks and sleep most of the time. Nevertheless, they receive too little food to keep them satisfied, and most of the time they are ravenously hungry. Yet, even so, they are playful though mischievous, never ugly or treacherous, as are similarly half-starved dogs on the Labrador. Fortunately the so-called summer season is brief—it lasts from about June 20 or July 1 to August 20 or September 1.

Most of the puppies are born in the summer, and the Eskimo begin selecting new specimens for replacing old or lost dogs. Training of a dog begins when he is but a puppy. If he develops greater size and strength, or if he shows more than average intelligence, he is even earlier selected for the team and given preference in food and care. He is hitched into the team with older, trained dogs, and in a very short time learns the rudiments of his task and his position. If he measures up to his promise as a puppy, he requires but a few weeks to gain knowledge of what he must do and what he must refrain from. After taking part in the first kill, he realizes that sledging means the excitement of the chase, and food. Thenceforward he delights in the trail, awaits the harness and his hitching with eagerness, and works cooperatively with his driver and his fellows of the team.

Ancestry of Thule dog

One reason the Greenland dogs are not so vicious as those of the Labrador, and elsewhere, is that they are farther removed from their wolfish ancestors, and do not bear so strong a strain of wolf blood in their veins. For many decades, perhaps for a century, the wolf has been extinct in Thule, and mating between dog and wolf is no longer possible. On the Labrador, and on other parts of the Arctic coasts where the Eskimo live, wolves are still common, and admixture of wolf with dog is a frequent phenomenon. As a consequence, many of the dogs on the Labrador are so treacherous and vicious that it is almost unsafe for a stranger to enter a village there without a club in his hand, or a native escort beside him.

Another reason for the relative gentleness and loyalty of the Polar Eskimo dogs is their undoubted partial Newfoundland ancestry. Altogether the Polar Eskimo dog on his native heath is a most friendly and devoted companion even under the most trying conditions, and not to be feared at any time or season.

Occasionally a particularly attractive puppy is selected as the house, or igloo dog, and becomes the household pet. He is accorded exceptional care and privileges, and though he rarely develops into a good sledge dog, he is given a generous part in the food supply, and treatment as one of the members of the family. Some hunters have little sentiment or sympathy for such pets, feeling that they add an unnecessary burden upon the family larder, and in times of stress, the household pet may find his way into the food supply as readily as any other dog.

In the autumn hunting season women as well as men are too busy to visit other villages, but when the winter season comes and the sun has set below the horizon for the full twenty-four hours of the day, there is a lull in the hunting. Then the sledges are repaired and relashed, the runners are repolished, the harnesses and traces are replaced, the dogs are fed well again, and everybody starts upon a program of neighborly visits from village to village along the whole coast.

And for the dogs, as for the people, it is a time of excitement, of meeting old acquaintances, of seeing new sights, hunting new game. With their tails curled over their backs in the best of health and spirits, the dogs fight gaily and indiscriminately among themselves, apparently reveling in the chance for physical threat and encounter. Such snarling and gnashing and showing of teeth only the wolf packs could equal.

The women are proudly decked out in the new garments they have made through the summer, the hunters boast new whip lashes, new field clothes, and perhaps new hunting equipment. The women have spared enough time from their summer duties to tan very carefully their best furs and skins and sew them into comely costumes for the envy of their relatives. Vanity is as widespread as femininity, it would seem. It is a season of feasting and gossip, of interchange of plans and experiences, of song fests and hunting parties.

Huskies have individuality

The Eskimo dogs vary significantly in their individual qualities and traits. Some are much more conservative and poised than the general run; on the other hand some are so vivacious and excitable that they become difficult of discipline and lack dependability. Very few are surly. Most are responsive, particularly when on the trail. Some are selfish; some greedy. Some are lazy, and they are soon discarded from the team. Some are more quarrelsome than are others. Some are much more courageous and confident of their prowess and ability to care for themselves.

The dogs share with their driver the skill of the trail and chase, but in varying degree. Some dogs are so superior for seal-hunting or for bear-hunting, as to achieve high repute throughout the Polar Eskimo group. A good bear-dog is much to be desired and, when found, is given every consideration. The dogs are trained from puppyhood to hunt bear, and once they have taken part in the excitement of the chase, they are not to be restrained.

When the team crosses the fresh track of a polar bear, the whole team turns as a unit to take up the scent and, no matter how worn and fatigued, dashes off in pursuit. The driver has little choice but to hang on to the sledge with all his strength, without attempting to control his dogs; for woe betide him if he is tumbled off.

The mad dash for bear

The dogs dash on in wild and eager chase with no thought for their driver. If he fall off, so much lighter the sledge! And it may be a matter of ten, or fifteen, or even more miles before the dogs finally drive the bear into the open water or "tree" him on an iceberg. The driver who does not hang to his sledge may have to trudge all those miles over rough ice, or deep snow, or both, before catching up with his team.

The dogs cannot kill the bear; they merely bait the poor beast and keep him from escaping until the driver despatches him. Usually the dogs are not hurt, for they evade the bear's clutch or the heavy blow of his paws; but occasionally a careless or overdaring dog gets too close to the bear and then he is pretty likely to suffer injury. The driver, when he makes the kill, always gives the dogs a share in the flesh of the bear. Much of the flesh, and of course the heavy pelt, fall to the driver's portion.

The period of a dog's active service in the team depends in part upon the driver. An Eskimo who is considerate of his dogs, who ably looks after their food supply, their health, their comfort, loses but few of his dogs, and drives them five or six years, but rarely more, before they fail him. A poor driver or poor hunter loses his dogs through accident or starvation much more quickly.

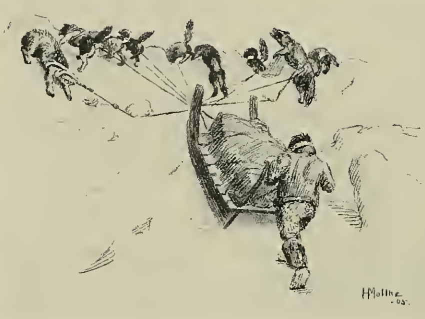
Yet even the best of hunters may sometimes lose his team or most of it, despite his utmost care and precaution. Epidemic rabies sometimes invades Thule, and then the good dogs, the good teams, suffer as severely as the poorest. Heavy and unexpected fall of soft snow may catch a hunter hundreds of miles out on the trail, and before he can get back, most of his dogs may have succumbed. A sudden change in the wind may break the ice away and carry both dogs and driver out to sea; the driver may return, for he may feed on his dogs, and await the drift of the ice back to land, but the dogs rarely survive.

Man's best friend

The history of the Polar Eskimo is a long record of dependence upon his dog. Hunting upon the ice rather than in open water is the chief activity of this group and for this pursuit, as for the hunting of bear, musk-ox, and caribou, the dog and sledge are essential.

The dog constitutes the final, and perhaps the most important link in the long chain of environmental factors that make human life possible in Thule, a thousand miles within the Arctic circle, and enable the Polar Eskimo to maintain his permanent residence and to live happily within the very shadow of the Pole, on the ultimate frontier of the Arctic.

Perhaps nowhere else in the world is the bond of inter-dependence and loyalty between man and dog stronger than among these people of the North and their dogs!



Over pack ice. From Rasmussen's "People of the Polar North," courtesy of Lippincott

Eskimo Dogs—Forgotten Heroes

The Eskimo dog of North Greenland is loyal, affectionate, and gentle, happiest when in harness and on the arduous hunting trail

Photo by
F. M. Weyer, Jr.

(Below) These dogs are fresh, as their up-curled tails indicate, but if necessary they would die of starvation or overstrain, lapping the hand of their master who suffers with them

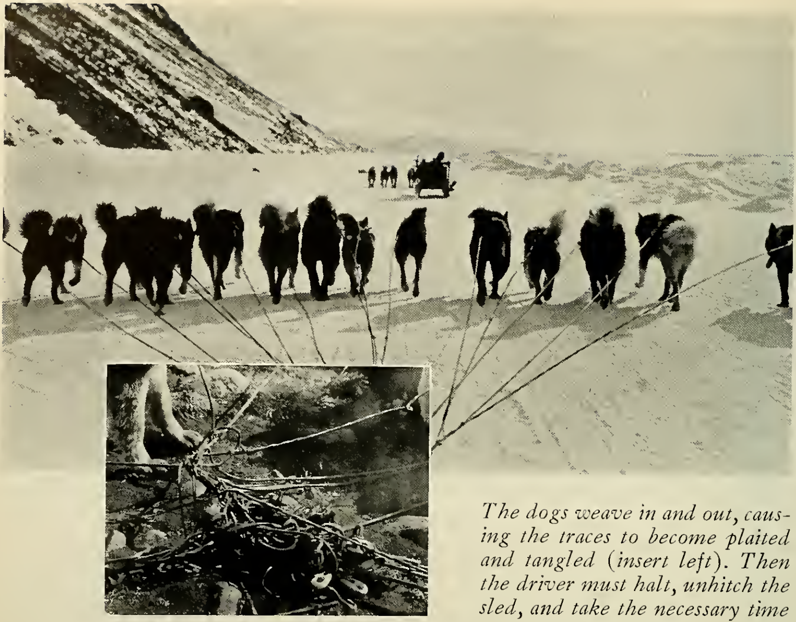
EATING (*Above*) *Large chunks of frozen walrus meat are gulped down whole. Until they are thawed out in the stomach, one can feel the projecting corners through the skin*

WORKING (*Below*) *"Huk! Huk!" and a crack of the whip above them is the signal which starts the team. The Polar Eskimos drive their dogs in fan-shaped formation*

Photo by E. M. Weyer, Jr.

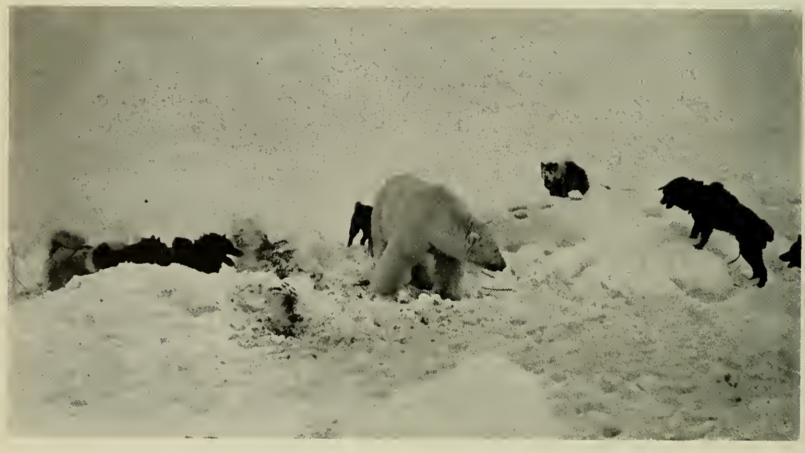
FIGHTING (*Above*) *Every team has a "king dog," which periodically trounces every other male dog in his gang. To his master he is true to the death*

RESTING (*Below*) *On the salt sea ice. The dogs must be allowed frequently to bite out from between their paws the lumps of packed ice which form there*



The dogs weave in and out, causing the traces to become plaited and tangled (insert left). Then the driver must halt, unhitch the sled, and take the necessary time to untangle the lines

(Below) When the team crosses fresh tracks of a polar bear, it dashes off in pursuit. The dogs keep the bear from escaping until the driver brings him down



In springtime, lakes appear upon the sea ice. Then there is great splashing, and the driver must watch the depth or he and his load may get soaked. If a line becomes fouled (insert right), one has to go wading in ice-water

(Below) The puppies, like all young dogs, are playful and friendly. Occasionally one of them wins a place as an igloo pet instead of a sledge dog

"What is the man with the box doing?" The dogs at the left are registering curiosity, which is one of their prominent traits

(Right) Training in harness generally begins when the dogs are scarcely more than puppies

(Below) In the lee of a pressure ridge. A heavy coat of warm hair keeps the husky comfortable at fifty below

Science in the Field and in the Laboratory

The Roosevelt Memorial, Astronomy, Lectures, Health, Meetings of Societies, New Members

Edited by A. KATHERINE BERGER

The Roosevelt Memorial Dedicated

The New York State Theodore Roosevelt Memorial Building, perpetuating the life and work of Theodore Roosevelt, was dedicated in the City of New York on Sunday, January 19, 1936, at two o'clock, and its administration delegated to the Trustees of the American Museum. A complete description of the Memorial and the dedication ceremonies will appear in the March issue of NATURAL HISTORY.

Amateur Astronomers Association

On Wednesday, February 5, at the regular meeting of the Amateur Astronomers Association, Dr. Robert I. Wolff, of the department of physics of the College of the City of New York, will speak on the subject "Nebulæ."

On Wednesday, February 19, Dr. Jan Schilt, head of the department of astronomy at Columbia University, will talk on "Stars of High Density."

These meetings are open to the public free of charge and are held in the large auditorium of the American Museum at 8:15 P. M.

Planetarium Special Lectures—1936

The first series of special lectures in the Planetarium was received with so much enthusiasm that a second series has been arranged. The six special lectures of the second series are to be given on the second and fourth Wednesdays of each month at 6:00 P. M. in the Planetarium dome, illustrated by means of the Zeiss Projection Instrument with lantern slides and motion pictures. They include:

February 26—Earth and Neighbor Worlds
March 11—The Midnight Sun: The Sky at the North Pole
March 25—Spring Constellations of Our Home Sky
April 8—Comets and Meteors
April 22—The Precession of the Equinoxes—Looking Backward and Forward in Time
May 13—Our Place in the Milky Way Galaxy

These lectures will be given by Dr. Clyde Fisher, curator of astronomy and the Hayden Planetarium. The subscription to the series is $2.50. Admission to any individual lecture can be had only by subscribing to the entire course.

Lectures at the American Museum

The lectures for the spring season for children of members will be held on alternate Saturday mornings at 10:30 o'clock, as heretofore. The two for February are:

February 15—Thrilling Words and Ways of Birds. By Mr. C. C. Gorst. February 29—Neighbors of Sand and Sea. By Dr. George H. Sherwood.

The lectures for members Thursday evenings at 8:15 o'clock are: February 13—Ethiopians and Their Stronghold. By Dr. W. H. Osgood. February 27—Soil-less Plant Culture. By Mr. Arthur C. Pillsbury.

The spring courses for teachers, given in coöperation with the College of the City of New York, New York University, and Hunter College, open the first week of February. The subjects covered at the College of the City of New York are "The Museum in Elementary Social Studies," "Nature Study," "Health Education," "The Museum in Economic Geography"; at Hunter College, "Nature Study for City Teachers," "The Museum in Elementary Social Studies," "Astronomy"; at New York University, "Astronomy for Teachers."

Full information about these courses may be obtained by addressing Dr. George H. Sherwood, curator of education, at the American Museum.

Six lectures for students in elementary biology and general science will be held on Tuesdays at 3:40 P. M., beginning March 3, with a talk by Dr. Walter Granger on "Exploring for the American Museum". Others are March 17—Penguin Personality. Dr. R. C. Murphy. March 31—Meshie, the Child of a Chimpanzee. Mr. Harry C. Raven. April 21—Audubon, the Bird Lover. Mrs. Grace Fisher Ramsey. May 5—Wild Birds and Their Human Appeal. Mr. Paul B. Mann.

May 19—Are You Going to Camp This Summer? Miss Farida A. Wiley. Five lectures on the "Biology of Man" for students in general and advanced biology are scheduled, viz: March 10—The Thinking Machine. Dr. G. K. Noble. March 24—The Gland Regulating Personality. Dr. G. K. Noble. April 7—Prehistoric Life. Dr. G. G. Simpson. April 28—The Human Machine. Dr. H. J. Clausen. May 12—Heredity and Environment as Factors in Life. Dr. G. C. Wood.

In the Museum Auditorium, Saturday afternoons at 2 o'clock there are free motion pictures. During February these will include: February 1—Vincennes. February 8—Bottom of the World. February 15—Abraham Lincoln. February 22—George Washington. February 29—Wolfe and Montcalm.

Health Instruction for Nurses

For four years groups of nurses from all the outstanding hospitals in New York City and from towns as far away as Middletown, N. Y. have been coming to the American Museum for instruction in Health, Comparative Anatomy, Hormones, etc. Dr. William Lord Smith has been conducting these classes, illustrating his talks with motion pictures on "How Life Begins," "Water Supply," "Pasteurization of Milk," and "Human Circulation and Digestion." The requests for this instruction have been steadily increasing, and in the last six months twenty-four hospitals have sent 578 nurses to the Museum.

The Malvina Hoffman Bronzes

The legends under the two bronze figures of African natives by Malvina Hoffman that appeared on pages 88 and 89 of the January issue of NATURAL HISTORY should have included the fact that these figures were reproductions of originals owned by the Field Museum of Natural History, through whose courtesy Mr. George A. Pratt purchased the bronzes.

The American Polar Society

The first annual meeting of the American Polar Society was held on Monday evening, November 25, at the American Museum. Mr. Paul A. Siple, president of the Society, presided. In addition to telling briefly of his experiences in Marie Byrd Land, Mr. Siple discussed some of the problems Lincoln Ellsworth would face if he landed before reaching Little America on his latest Antarctic flight.

Mr. Joerg of the Executive Board, the polar expert of the American Geographical Society spoke on the Arctic work of the late General A. W. Greely.

The entire membership then spent some time seeing the polar material in the Museum.

Just about one year ago (November 29, 1934) a group of friends and relatives of men who were then exploring in the Antarctic with Admiral Byrd and with Dr. Lincoln Ellsworth, formed the American Polar Society to band together all persons interested in the exploration of the polar regions, in order to act as an American clearing house of polar information, to be of aid to organizers and members of polar expeditions, and to spread knowledge of the polar regions.

Toward this end the American Polar Society is collecting books, reports, maps, photographs, etc., relating to the polar regions. The Society keeps in close touch with the Scott Polar Research Institute in Cambridge, England, the New Zealand Antarctic Society, the Arctic Institute at Leningrad, and other groups throughout the world interested in polar matters.

The Society has among its members, who live in twenty-two states and seven foreign lands, men who served in the polar regions under Admiral Robert E. Peary, Capt. Robert Falcon Scott, Sir Ernest Shackleton, Admiral Richard E. Byrd, Dr. Lincoln Ellsworth, and Dr. Jean B. Charcot. Doctor Charcot, himself a member, is the sixty-nine-year-old French polar explorer who sails to Greenland each summer in his sailing vessel, the "Pourquoi Pas?" in which he led two Antarctic expeditions in 1908 and 1910.

In addition to Mr. Siple, the president, the officers of the Society are: Russell J. Walrath of Westfield, N. J., chief cartographer of *The New York Times*, who is vice-president; August Horowitz of New York City, editor of the Society's twice-yearly publication, *The Polar Times*, secretary, and Marshall S. Delavan of Mt. Vernon, N. Y., treasurer.

The Society's Executive Board consists of Dr. Lincoln Ellsworth, who was co-leader with Roald Amundsen in the dirigible "Norge" on its successful flight from Spitsbergen to the North Pole and thence to Alaska (in 1926) and who last fall flew about 2100 miles with his pilot, Herbert Hollick-Kenyon, across the Antarctic Continent from Dundee Island on the Weddell Sea to a point twenty miles from Little America on the Ross Sea; W. L. G. Joerg, polar expert of the American Geographical Society of New York; Dr. Hugh Robert Mill, Great Britain's eminent Antarctic historian; Prof. Frank Debenham, director of the Scott Polar Research Institute of Cambridge, England, who in 1910-1913 was geologist on Captain Scott's last Antarctic expedition; Henry Woodhouse of New York, president of the Aërial League of America; Fred E. Meinholtz, director of Communications of *The New York Times*; Charles Gill Morgan of Dallas, Texas, geologist of the recent Byrd Antarctic Expedition; B. A. Heimbinder, Miss Lorene K. Fox, and C. Walter

Seamans, all of New York, and Donald H. Cooper and Miss Margaret McGrain, both of Washington, D. C.

August Horowitz besides fulfilling the duties of secretary of the American Polar Society, is editor of *The Polar Times*, official organ of the Society, which is published twice a year. Associated with August Horowitz on *The Polar Times* as art editor is Herbert R. Loges of New York City. For eighteen months during the recent Byrd and Ellsworth Antarctic Expeditions these two men published a monthly newspaper, the *Little America Times*, for friends and relatives of the explorers with the Byrd and Ellsworth parties.

The Society holds its meetings at the American Museum of Natural History, its official mailing address. At least two Society meetings are planned each year, in addition to the annual meeting. The membership fee is one dollar a year.

Paul A. Siple, of Erie, Pennsylvania, nationally prominent in the Boy Scout movement, and chief biologist of the recent Byrd Antarctic Expedition, was elected president of the Society in October, 1935.

RECENTLY ELECTED MEMBERS

A REPORT from the membership department lists the following persons who have been elected members of the American Museum:

Life Members

Messrs. William A. Chryst, Otto H. Hafner, Arthur S. Litten, Wesley W. S. Mueller

Sustaining Members

Mrs. Wortham James

Dr. J. C. Burnett

Messrs. William A. Ayerigg, Robert H. Thayer.

Annual Members

Mesdames Miner D. Crary, W. G. Elmslie, W. D. Gregory, Stoddard Johnston, Dean Mathey, R. E. McCormick, C. P. Meadowcroft, James C. Rea, Hannah T. Vosper.

Sister Mary Oswin

Misses Elizabeth Achelis, Frances Achilles, Ruth T. Fitzell, Ella E. Geughof, Johanna M. Topkins, Margaret A. Lindquist, Esther C. Olsen, Charlotte C. Pardee, Charlotte C. Swan, Eleanor Tobias, Evelyn van Duyn, Mildred S. Wolf.

Doctors David C. Bull, Glenn H. Whitson.

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Reviews of New Books

Animal Photographs, American Trees, Exploration, Birds and the War

WILD ANIMALS. *Edited by Helen Sidebotham. Life and Art in Photograph, No. 6. Oxford University Press, $2.00. 100 plates.*

THIS is a volume composed entirely of halftones pictures which carry short captions. There is a brief introduction by the author who states "The aim of this book is to give a glimpse of life in the wild and to show how animals look in their natural surroundings." The difficulties of photographing wild life in its natural environment are contrasted with the ease of securing photographic records in the Zoo. The net result of a careful reading of the introduction is to prepare one for unusual and bona fide photographs.

There are a number of very excellent illustrations in this volume and the names of well-known photographers vouch for the authenticity of many of these. The selection is world-wide in its scope, and the subjects are all mammals, the author apparently preferring the popular designation of "animals" to the more precise terminology of "mammals" which would exclude the birds, reptiles, fishes, etc.

It is to be deplored that this volume has not lived up completely to the high standard set by the work of some of the contributors, and that the departure from this high standard goes so far as to bring in faked pictures. Plate 11 (Puma leaping on prey) is such an illustration, and the history of this photograph was given in *Nature Magazine* for December, 1934. It is quite obvious to any one who has studied or photographed wild life that a photograph of a puma launched in mid air upon unsuspecting deer must by the very nature of things be a "fake."

Plate 96 of the Himalayan Goat which, by the way, is our own North American Rocky Mountain goat, not only discloses a lack of knowledge of mammal life on the part of the editor, but also shows what can be done by posing a mounted specimen in a naturalistic surrounding. Plate 61 is captioned "Young Moose or Elk (America and Europe)" which is very misleading to an American audience since the animal obviously cannot be both. The Duck-bill Platypus is given New Guinea as a homeland, where it has never been taken, and the veriest tyro in nature study should know that this is a classic representative of Australian wild life. Plate 64 purports to show a herd of reindeer or caribou, but the animals are obviously wapiti or, to the American sportsman, elk.

Some of the photographs have all the appearance of having been taken in zoölogical gardens. To attempt to go into these in detail might create an impression which would be unfair to the many interesting and bona fide wild life photographs in the volume. The reader of this book is cautioned to employ his powers of discrimination and not to take too much for granted.—H. E. ANTHONY

SOME AMERICAN TREES. *By William B. Werthner; The Macmillan Company, New York, 1935, 398 pp.; $5.00.*

THE majority of books relating to botanical subjects are designed as technical references and not as pleasant reading material. This is inescapable, of course, for the study of botany presents endless ramifications wherein a single family of plants often demands volumes of descriptive writing to aid the student.

Doctor Werthner possesses the faculty of successfully combining definite information with delightful reminiscences of hours spent in forest and park, among his friends, the trees. His book will open the eyes of many to the recreational and educational values of objective walks through the woods.

Trees will become friends to be greeted anew upon successive open-air excursions. Shagbark hickory, with its ragged coat of bark, and the wild plum, covered with lacy white blossoms, will abandon their place in the landscape and step forth to be acknowledged. Various beauties will meet the tramper's eye as he seeks the orange and red berries of the bittersweet, and the robins and cedar waxwings in the hackberry at different seasons of the year.

Detailed descriptions of buds, twigs, leaves, and fruit are interspersed with sketches of the commercial values of trees. One learns of the farm boys' use of woodland products, too. The author recalls his mother's rose-colored sassafras tea, the ingredients for which he collected in the woods at the edge of town. Then there is the colorful touch given by flowering dogwoods to a green hillside, the smouldering red and yellow torches of the maples bursting into flame at the coming of frost.

Doctor Werthner died before his book was completed. Readers will owe a debt to his wife who carried on the work and succeeded in having it published. The vicinity of Dayton, Ohio, is the region included in the book, though many of the trees range throughout the country. The author evidently had his friends and neighbors in mind, for he mentions numerous definite Ohio localities. However, the descriptions are so vividly written that readers in California and Maine will enjoy and visualize them.

A summary condenses recognizable features of each species into a few easily recalled "earmarks," as Doctor Werthner expresses it. This is an excellent book for the identification of trees in winter and summer and for its three hundred photographs by the author to show numerous details of structure. Nature workers in all fields will appreciate *Some American Trees.*—Kenneth M. Lewis

THIS BUSINESS OF EXPLORING. *By Roy Chapman Andrews; G. P. Putnam's Sons, New York, 1935. 288 pages, 31 photographs, and a relief map of Mongolia. $3.50.*

Doctor Andrews here adds another book to his already rather long list of volumes on exploration and adventure in various parts of the world. Here again we find his stories told with the same simplicity, directness, and enthusiasm which have characterized his other books and made them such good reading and which, through the spoken word, have made him one of the most popular men on the American lecture platform during the past ten years.

The present book is divided into two sections; the first half is made up of various stories drawn from the author's rich experience. Some of these stories are new and some are reprinted from magazines in which they first appeared. The second half deals entirely with the explorations of the Central Asiatic Expeditions in Mongolia during the years 1928 and 1930, and supplements and completes the account of these Expeditions begun in the book *On the Trail of Ancient Man*, which dealt with the earlier years of that exploration.

The first chapter, entitled "Exploritis," deals with the generalities of exploration. There are, the author says, but few areas left on the face of the earth which have not been visited, written about, and mapped, but there are vast areas which are still open to intensive scientific exploration—the exploration of the future. Not only has the type of work changed, but the methods of doing it are changing rapidly. The motor car and the aeroplane are in many regions taking the place of the camel caravan, the canoe, and the native carrier.

Doctor Andrews takes occasion in this chapter to answer the often made inquiry by boys and young men "How can I be an explorer?" and his answer is "Train yourself for a technical or scientific job which fits into exploration," and he wisely adds the caution that the glamour of exploration is usually dispelled as soon as the party takes the field and there must be something back of the successful field man besides a mere desire for adventure.

The dangers of exploration are treated in another chapter, and while the author is the last man in the world not to make the most of any unusual or exciting incident, he sums up his real attitude on this subject by the statement that he always feels much safer in the heart of the Gobi than on the streets of New York City—a feeling shared by the present reviewer.

Other chapters in this first section include an excellent dog story—the story of the police dog "Wolf" who accompanied the party into Mongolia on three occasions; and there is a touching tribute to MacKenzie Young, who, as chief of motor transport of the Central Asiatic Expeditions for four years, piloted us through many difficulties and who had more real exciting adventures and suffered more real hardships than anyone else in the party, only to meet a mysterious and untimely death in northern California after it was all over.

The second part of the book is a straight narrative of the last two years of exploration in Mongolia by the Central Asiatic Expeditions. It tells of the ever increasing political difficulties encountered in Peking, difficulties which finally became insurmountable and brought this great exploratory work to a close at the end of the 1930 season. Here again are stories of sand-storms, of the menace of bandits, of the reaching out into new territory, both to the East and the West, and of those daily happenings both on the trail and in camp which made life in the Gobi anything but monotonous. There are also accounts of the new discoveries of creatures which inhabited Mongolia in the geologic past including those two extraordinary animals—the battering-ram-nosed titanothere and the shovel-tusked mastodon, and one chapter is devoted to additional finds of that giant of all land mammals—the *Baluchitherium*.

The volume closes with two appendices: one of them tells briefly the story of those Neolithic inhabitants of the Gobi known as the Dune Dwellers, and the other summarizes the results of the Central Asiatic Expeditions over its ten years of work in China and Mongolia.

Most of the stories in this volume I have heard before, in fact I have lived many of them with the author, and yet I have read them all again with keen and renewed interest because they are told with that vitality and enthusiasm which makes Doctor Andrews an inspiring leader as well as a virile writer. It is this spirit which has created in so many of the youths of the country a burning desire to go and do likewise.—W. G.

BIRDS AND THE WAR. *By Hugh S. Gladstone. Skeffington & Son, Ltd., England.*

IN *Birds and the War*, Mr. Gladstone has given us numerous stories regarding the effect of war upon the bird life within the region of conflict in France and in other countries where fighting took place during the great war. We often read of the use of the homing pigeon to carry messages, particularly in times of war. Thousands of them were used for this purpose during the World War. At the beginning they were thought to be obsolete as conveyors of messages. It was soon found that there were numerous times when a pigeon succeeded in reaching its loft with an important message after telephone and telegraph had failed or could not be used. The information, when written and folded, was placed in a little metal capsule which was attached to the bird's leg. When the bird reached its home loft, it crept inside. Its weight pressed on the platform within, which completed an electric current, ringing a bell that announced its arrival. Some of them have been known to fly as far as three hundred miles. They usually were allowed to make only one flight a week. If they were wounded they were immediately pensioned off, fed well, and became great pets.

The Pigeon Service was used on sea as well as on land. At one time an English seaplane was forced down in the North Sea and was in danger of being dashed to pieces by the heavy waves. A pigeon was released and in twenty-two minutes it had flown twenty-two miles; help was sent at once, and the airmen were found clinging to the wreckage of their ship.

Pigeons were not the only birds used during the war to convey various kinds of messages. Parrots proved to be very sensitive to noise and would set up a chatter announcing the approach of aircraft fully twenty minutes before human ears could detect it. They could not, however, note the difference between the hostile and friendly airplanes, so their use was not so extensive. Canaries, we know, are used in mines today to detect the presence of gas. They were almost unfailing in their warning on the battlefields, and they were used in large numbers. Their limp little bodies would be lying at the bottom of the cage before a man was scarcely affected by the enemy's poisonous gas. They were also taken along when tunneling was being done to detect any subterranean gas. The soldiers made great pets of them and kept them in the safest places possible.

Many soldiers found great interest and comfort in watching the wild bird life about the trenches on the front lines. One would surely think that wild life of all sorts would flee from such a dangerous zone. This was not true, however, of the birds. They seemed for the most part plentiful and unconcerned. They arrived in the spring, nested, cared for their young, and departed in the fall as was their usual wont. They seemed indifferent to the noise of battle. In "No-man's Land" birds were everywhere, even more numerous than before.

It was noted that nightingales sang even more sweetly, if possible, in the war zone than ever before. In spite of the deafening noise of a violent cannonade one night, a nightingale sat in the shelter of a hawthorn bush and sang gaily through it all, never pausing till the dawn. It was found that his mate had a nest in the bush and was sitting on her eggs, apparently undisturbed by the uproar.

Warblers and other birds built their nests with calm indifference amid heavy firing, and reared their little broods as usual. Sparrows were especially fond of building in old wagons not in use. Swallows placed their nests comfortably in dugouts. Little chaffinches considered wire entanglements ideal places to nest when their briar hedges had been torn away. They could be heard singing whenever there was a lull in the almost incessant firing. Storks also seemed indifferent to the guns and returned to old nesting places on the ruined buildings as usual. Wild ducks and swans followed their usual habits of feeding and nesting with no regard for bursting shells.

The soldiers were generally kind to birds, proving that all was not brutality in the war. An officer once stood for half an hour beside a plover's nest to prevent the eggs from being damaged by the passing troops. They were often heard comparing notes on their observations of birds and they cared for nests they happened to find.

Similar reports of bird reactions to the war came from other battle fronts, Italy, Palestine, and Macedonia. Some claim has been made that the migration routes of various birds were changed to avoid the areas over the battlefields. The author believes, however, there is sufficient evidence in the presence of all sorts of birds in the battle regions that this contention is not true. He believes the birds throughout the war followed their usual instinctive habits as always, with slight adaptations to the changed local conditions.

—LENA MAE POOLE

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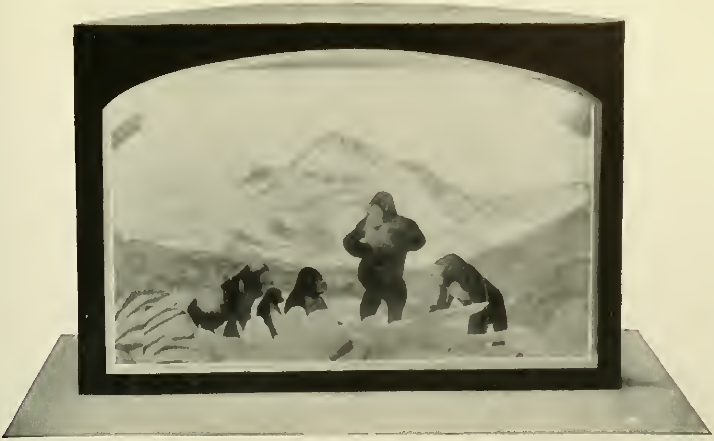

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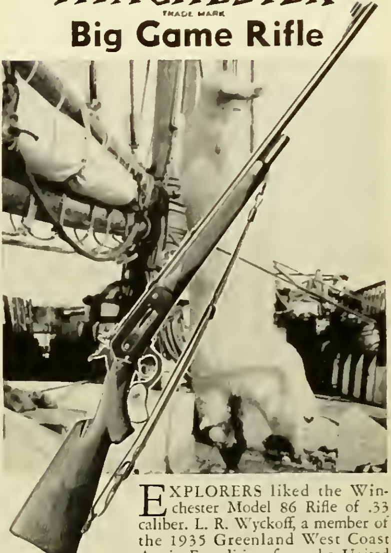

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No. 5

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The Journal of the American Museum of Natural History

VOLUME XXXVII ★ ★ ★ ★ MAY 1936

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The water can be seen plainly in the natural "bottle"

THE INDOOR EXPLORER

By Gordon Lawrence

It seems that it did not take the Indians of the eastern seaboard very long to realize the advantages of clothes cut in an approximation of the European manner. Until the country was settled by the whites the Indians wore a sort of poncho or night shirt made of two skins for an upper garment, and hip-length leggings in lieu of breeches.

But the costume of our eastern Indians changed quickly after white settlement, according to Dr. Clark Wissler. To illustrate this, the department of anthropology recently installed a costumed life-sized figure of an Indian of the New York region during the period of the American Revolution. This brave is carrying a gun almost as tall as himself, a knife, and a tomahawk, all bought from white traders, and wears a sash of beads and bead ornaments procured from the same source. His black hair is done up in two braids tied up with red cloth.

The rest of the Indian's costume, moccasins, fur cap, rawhide coat, skin breech cloth, and leggings, and the shell ornament on his neck, as well as his powder horn, are obviously of home manufacture, but the design of the coat is, of course, to some extent imitative of European clothing, and the cap has a cloth sweat band.

To the layman, it seems curious that while the Indian was taking over the coat, he did not also adopt what seems to be the most practical garment ever devised, that is, trousers. As Doctor Wissler points out, "Even today Indians on some reservations wear long cloth leggings instead of trousers."

Natural water bottles

The skeptical youth who had been staring at the semi-precious gems was polite but reserved when Curator Whitlock assured him that opals did have water inside them, even if you couldn't see it or feel it. The boy complained that the glassy surface of the opal didn't seem in the least wet to him.

But his air of world weariness lightened when Mr. Whitlock drew forth some of his natural water bottles. The Museum has a lot of them and the water in them is assumed to be potable. You pick up a large blob of dull white quartz—shake it, and you hear an internal gurgling like that of the milk within a ripe coconut. Some of these naturally sealed containers are semi-transparent and when they are held up to the light the water inside looms up like the horizon through a January fog.

None of the water bottles in the Museum has yet developed a leak, according to Mr. Whitlock. They are to be discovered wherever geodes are found—which is wherever silica-impregnated water has filtered down through certain rocks, basalt, for example. The water drips down into any cavities in the rock, and if these are at a considerable depth, and consequently under heavy pressure, the mineral matter in suspension in the water eventually crystallizes around the sides of the cavity, to form a more or less rounded container for the pure water left inside. When the bottles are sawn in two, the quartz crystals are seen lining the interior like the amethyst crystals of a grotto. As a matter of fact, as Mr. Whitlock points out, these water bottles are grottos in miniature.

The farthest south in fish

THE MUSEUM has received what is presumably the most southerly specimen of a fish ever collected, and considering that this inch and a half long individual was found by Mr. James M. Sterrett of the Second Byrd Antarctic Expedition in a seal hole in the ice at Echo Canyon, some sixteen miles southwest of Little America, it is not likely that living fish can ever be found much farther south.

The fish, which looks pale and homely enough reposing in alcohol, has been named *Pagothenia antarctica* by Mr. J. T. Nichols and Miss F. R. LaMonte. In life it apparently spent most of its time close to "narrow crevices or pockets in the wall of the crevasse" into which it retreated when disturbed.

Pagothenia was taken in approximately lat. 78 45′ S. From a very short distance farther north the Museum received a series of a somewhat larger fish, *Pleuragramma antarcticum,* which, according to Mr. Paul Siple, of the Byrd Expedition staff, is apparently the major food of the Weddell seal. One seal was found to have about 400 of these fish in its stomach.

As Mr. Nichols points out, "This *Pleuragramma* held the record as the most southerly fish ever captured by man prior to the last Byrd expedition—and it was known only from a few fragmentary specimens. From the abundance of sea birds and the numbers of seals in the Antarctic it is evident that the fish life of these waters must be a rich one."

Fossil hunting at home

WHEN AFRICAN HALL and the Roosevelt Memorial were erected, the Museum received a large accession of fossil specimens without sending out any expeditions to procure them. These fossils, one might say, were thrown in with the buildings. The smooth and creamy Pandora marble that panels the upper hallways and stairways of the Roosevelt Memorial entombs what remains of many an ancient creature that once fringed old sea beaches.

The numerous irregular figures that show so plainly in the polished surface of this rock are cross-sections of calcareous algæ (*Lithothamnia*) most closely related to the lime secreting algæ of the mid-Tertiary periods, according to Dr. Chester A. Reeds, Curator of Geology and Invertebrate Palæontology. More striking are the occasional elongated shells, with a structure that vaguely resembles a corkscrew to the uninitiated. These were identified by Doctor Reeds as univalves (Gastropoda), a group that was very abundant during the Mesozoic and Cenozoic eras and are still found in large numbers along our present-day seashores.

The beautiful slabs of the mottled reddish Spanish marble, the so-called Catalan Red, which serve as base-boards in the Roosevelt Memorial Building, reveal, on close search, the wheel-shaped outlines of fossils which represent cross-sections of cup corals with radiating septa. Some millions of years ago these coral animals were leading the same uneventful life in placid marine waters that their cousins do today.

A still richer field of fossils is found in the Napoleon Grey marble in the lavatories in African Hall. This stone is brownish-grey in color, and its glassy-smooth surface shows a subcrystalline close-grained rock representing vanished beaches almost as plainly as when the waters of ancient seas lapped over them. The history of the beach can be read plainly in the alternating deposits; some bands show grains so small that they can hardly be seen.

Scattered through these bands are a vast number of single curved valves of the brachiopods *Spirifer logani, Spirifer orbicularis* and *Syringotheras subcuspidatus,* which made an easy living by placidly straining out the tiny animals and plants abundant in the shallow seas of middle Mississippian time. Then there are a large number of round objects, that look something like ancient coins, which represent transverse sections of crinoid stems and cup corals, according to Dr. Reeds. The most striking of the oblong and slightly curved shells with radiating partitions that divide the shell into chambers represent longitudinal and tangential sections of the cup coral *Zaphrentis centralis.*

The Department of Geology has on display rocks in which fossils are much more thickly crowded than in these. A good example is the Nerinea limestone, from Syria, the polished surface of which is so packed with the carrot-shaped shells of *Nerinea fleuriausi* that the chalky limestone seems merely a matrix for the long brown shells.

On the distribution of Birds

It looks as if the 1200 copies of Dr. Robert Cushman Murphy's monumental *Oceanic Birds of South America* were going to be pretty well distributed over the known world.

President Franklin D. Roosevelt, who bought two copies, was one of the first subscribers. Other early purchasers were Prince Taka-Tsukasa, the Marquis Hachisuka, and the Marquis Yoshemaro Yamashina, all of Tokio, Sir Charles F. Belcher, governor of Trinidad, and the head of the Tribal Council of the Navajo Nation, Thomas E. Dodge by name, who maintains his headquarters at Fort Defiance, Arizona, over 400 miles from the nearest salt water and presumably that far from the probable line of flight of any salt water birds.

Among the very first and most appropriate subscriptions for a treatise on South American sea birds was that of the Peruvian Guano Administration. Orders for five sets have already been received from Peru and eight from Russia, including subscriptions from the Siberian Section of the Russian Geographical Society in Irkutsk (which is three times as far from salt water as Fort Defiance is).

The farthest north for *Oceanic Birds* so far is the Landsbokasfnid of Reyjavik, Iceland, which is likely to retain this distinction unless some polar explorer takes along a set to while away the long Arctic night. So far no copies have been ordered for Antarctica, but among the famous institutions and people already purchasing the book are the Musee Oceanographique at Monaco, where Doctor Murphy once worked (and, of course, many of the more important museums and universities of the world), Boris A. Bakmeteff, last Imperial Russian ambassador to this country; John Bassett Moore; George Blumenthal, president of the Metropolitan Museum of Art; Mrs. W. L. Harkness, Duncan H. Read, Frank W. Benson, the etcher of shore birds and ducks; Childs Frick, Daniel E. Pomeroy, Leonard C. Sanford, Lord William Percy, George W. Perkins, Herbert L. Satterlee, Mrs. Harry Payne Whitney, who bought five sets; former Senator Walcott of Connecticut, John Hays Hammond, Jr., and the former King Ferdinand of Bulgaria.

Back in the dim days when Dom Pedro ruled in Brazil it seems that Ferdinand collected many a bird in that country. Later, when reigning in Bulgaria, he maintained a court ornithologist. His son and successor, the studious Boris, is also a naturalist by avocation.

A letter from Stefansson

This month Natural History publishes one of the first articles to appear in the United States on an important subject that is very little known, the exploration and the beginnings of the development of the Arctic by Soviet Russia.

There are no political inferences to be drawn from this article, of course, but there is abundant reason why Russia, of all nations, should be profoundly interested in the development of the Arctic. In the first place, something like four-ninths of the great circle of northernmost lands and waters is possessed by Russia, a much larger share than that of any other nation. And then there is that problem that has always bedeviled the rulers of Russia, whether Tsars or Communists—the fact that she alone, among the great nations, is practically ice-bound so far as ocean transport is concerned every winter, with only that one northerly ice-free port of Murmansk.

The editors of Natural History have received the following letter from the distinguished explorer, Vilhjalmur Stefansson, which serves as an interesting introduction to Mr. Shipman's article:

> "Natural History is to be congratulated on the news which I get from you that you are intending to publish a contribution on exploration and pioneering in the Soviet Arctic. For several years I have been following these activities as best I could, hampered by inability to read the original Russian in which many of the reports have been published. However, various serial publications of the Arctic Institute have been increasingly considerate of western scholars in printing summaries in English, French, or German. Indeed, a good many of the contributions, some of them of major importance, have been published in a western language. There are, too, western publications which follow and summarize the activity of Soviet explorers. Notable in this field, and increasingly complete, is the semiannual *Polar Record*, published by the Scott Polar Research Institute of Cambridge, England.
>
> "The summaries of the *Polar Record* demonstrate that for some years the explorers of the Soviet Union have been doing more in the Arctic than was being done in Arctic and Antarctic combined by the explorers of all the other nations of the world. By 1935 they had far outdistanced the combined achievements of the rest of the world.
>
> "The broad credit for northern scientific research and development goes, of course, to the general policy of the Soviet Government. Thereafter comes the leadership of Professor Otto Schmidt, whose office as director of northern development approaches what we would think of in the United States as cabinet rank. No nation in recent times, if any nation ever, has given such importance to geographic exploration.
>
> "The author whom you have chosen to present the subject. Mr. S. S. Shipman, is peculiarly well placed for securing complete and authentic information.
>
> "Again congratulations, then, to Natural History for taking up in semi-popular form, through Mr. Shipman's contribution, the enlightenment of English-language readers with regard to those northern activities of the U.S.S.R. which, in comparison with our own, are so colossal; and which hitherto have been little noticed except by technical students and those few others who consult the *Polar Record*."—Vilhjalmur Stefansson.

Is Redfern alive?

Nine years ago the young aviator, Paul Redfern, attempting a non-stop flight from Brunswick, Ga., to Rio de Janeiro, crashed down into the unmapped forest of Guiana. Since that summer of 1927 there have been strange stories, and even individuals who claimed to have met Redfern face to face in some unheard-of Indian village. But even the traveler who claimed that Redfern had taken himself an Indian wife was unable to substantiate his story.

When Doctor Kahn (whose article appears in this issue of Natural History) showed the moving pictures of his expedition at the Explorers' Club a lean and energetic listener displayed so much interest that Doctor Kahn took the pictures to the listener's office for a private showing. The interested gentleman was Captain Lewis A. Yancey, who himself flew in 1930 over the country where Redfern probably cracked up.

The finding of a white man

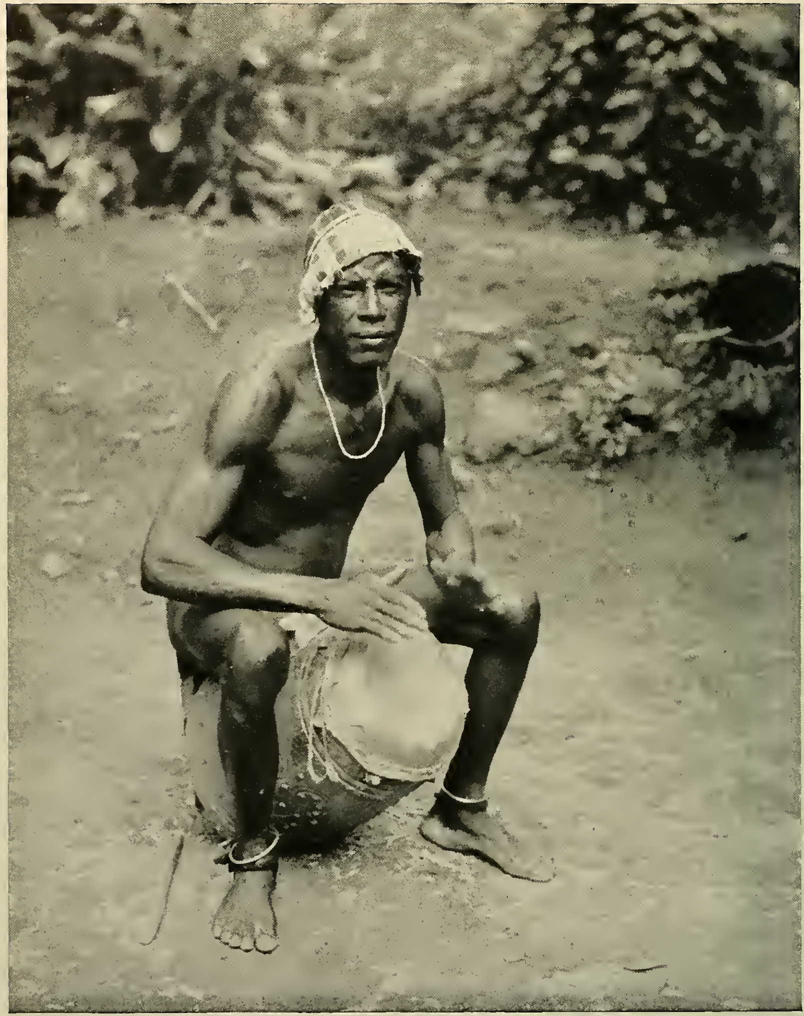
As Doctor Kahn reeled off the sequence of the Indian gesticulating to convey his story of the finding of a white man, Captain Yancey stared eagerly at the Alukuyana's pantomime.

"It can't represent anything but the intentional crack-up of a plane," he decided.

It seems that when your plane stalls twenty or thirty feet in the air the bounce you make on landing is likely to be a disastrous one. Captain Yancey himself has had the experience of deliberately smashing a wing, once, for example, when his plane dropped a valve near Nassau in the Bahamas. With no place to land except a small rocky beach, there was no room to do any bouncing. Yancey made a stalled landing, smashing the plane pretty thoroughly, but neither he, the radio operator nor the mechanic received a scratch.

Supposing that Redfern is indeed still alive, one wonders what one's own reactions would be if one were to drop out of a tropic sky down into a green wilderness among a people of a culture ages behind our own—and live there nine years, farther removed from our modern civilization than Mark Twain's Connecticut Yankee was when he cursed the suit of armor they gave him at King Arthur's court.

Two expeditions are now searching for Redfern. If they or anyone else ever find him alive there will be a great story to tell—of nine years or more of existence in the very backwaters of the world while expedition after expedition tried to pick up his trail, and now and then vague rumors came to the world he had left that somewhere in the silent forests of Guiana a fallen flyer was held captive.



BUSH NEGRO BEATING SIGNAL DRUM

The Bush Negroes, the descendants of rebel slaves, survive in a section of northern South America. Two centuries and more ago their ancestors revolted against the Dutch, fled into the jungle, and after a series of long and bloody wars, established their independence. Their culture shows many striking West African survivals. The apinti *or signal drum is used also for dances*

Where Black Man Meets Red

Adventures in medical research among two strange tribes of Dutch Guiana. Notes on the possible whereabouts of the aviator Redfern

By MORTON C. KAHN
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THE scientific explorer besides having to travel a certain distance into difficult country, usually faces the problem of securing the friendship of the natives among whom he is to work. This latter procedure, though rarely described in detail, involves some of the most interesting experiences.

My recent expedition to the back country of Dutch Guiana was unique in that it brought me into contact with primitive people of two distinctly different races, the black and the red. The Bush Negroes are that interesting group of blacks who, although they were transported to this hemisphere originally as slaves, won their freedom in armed conflict with the white man and maintain it to the present time. In a foreign setting they have retained to a remarkable degree the culture of their West African forebears. The Alukuyana Indians, of the red race, are the tribe who inhabit the country directly back of the Upper Aucaner Bush Negroes in the little known interior of Dutch Guiana. Many of them have never seen a white person.

One of my purposes was to make tuberculin tests on people of both these groups and to collect samples of their blood for purposes of grouping.

Upstream in dug-outs

With my two able assistants, namely Mr. Ralph F. Donaldson in charge of cinematography, and Mr. E. W. Rogalli of the Dutch Guiana Government Service, I proceeded by sea from Paramaribo the port of Dutch Guiana, to Albina just above the mouth of the Marowyne (Maroni) river, a distance of over a hundred miles. The Marowyne marks the boundary between French and Dutch Guiana, and from Albina one may see the town of St. Laurent which is the main prison port of French Guiana and the centre of the penitentiary system popularly known as the Devil's Island Penal Colony. Here we reloaded our baggage into five 40-foot dug-out canoes, and with the help of twenty-two husky Bush Negro paddlers proceeded on our way.

Today there are six tribes of Bush Negroes all descended from the rebel slaves of 190 and more years ago. On the Copenam River, there is a tribe known as the Quintee; those Bush Negroes who inhabit the upper Saramacca River call themselves the Matawaai; while the large tribe on the Surinam are interestingly enough called the Saramaccaner. Then there are the Boni on the French Guiana side of the Marowyne and Lawa rivers, and a small group, the Paramaccas, who inhabit the shores and islands of the middle Marowyne.

Once fugitives

But to my mind the most interesting of all the Bush Negro tribes are the Aucaners, descended from rebel slaves, who signed a treaty of peace with the Dutch in 1761 at the Ouca plantation. There are about 6000 of these people scattered in a less compact way on the rivers and creeks of the colony toward the French Guiana line. The tribe is divided into two parts known as the "Uppo Nengre" (upper Negroes) and "Belo Nengre" (lower Negroes). All members of the tribe living below the Gran Holo (Big Hole) Falls in the Tapanahoni River belong to the Belo or lower

Aucaner group, while the real aristocrats of the tribe live above this dividing line.

In the villages of the Upper Aucaners are found the clans or "lo" from which the King or "Granman" of the entire tribe is selected. These are the Otter lo and the Missi Jon. The Upper Aucaners live in the wildest and most inaccessible part of Dutch Guiana, and have had the least contact of any Bush Negro tribes with the white men.

After seven days of arduous paddling and poling over innumerable falls and rapids, we reached the end of the Marowyne River and entered the mouth of the Tapanahoni. The seat of the Chief or "Granman" of the Aucaner tribe is the village of Dree Tabiki (The Three Islands), but before one may enter this precinct it is necessary to inform the Granman and Council of one's proposed arrival and to await the necessary permission. This was accomplished by dispatching a small canoe two days ahead of my main party.

Overtures

The messengers returned and informed me that desired permission had been granted, but that my party was to wait at a certain point just out of sight of Dree Tabiki and to fire a gun three times as a signal. We were not to proceed until three gun shots were heard in answer from the village which would signify that Kanapé, the head Captain of the Aucaner tribe was ready to receive me.

Kanapé is not the Granman of the tribe. Since the death of old Amekti, some four years ago, however, Kanapé has been the official ruler. A young Bush Negro by the name of Matoja, is the rightful heir to the title but the Bush Negroes consider him too young and inexperienced for such a position, and will not inaugurate him until he is considerably older. When I saw him this winter, he appeared to be about twenty-five years of age.

After a wait of about two hours, I heard the gunshot signal from the village and motioned my canoes to fall in line one behind the other, which is the accepted etiquette of approach. As we paddled slowly to the shore most of the villagers were assembled there in colorful array to greet us, including the most powerful Captains of the tribe, who had been summoned by Kanapé for the ensuing *Krutu* or Council. As we approached the landing place the Bush Negroes fired several salutes from their old muzzle loaders and percussion cap shot guns while we answered with all available fire arms—rifles, shot guns and revolvers. After several such salutory exchanges my canoe finally touched the shore from which I was assisted in a most dignified way by the Reception Committee, composed of Captains Gagoo, Abompé, Sekendo, Sava, Tonka, Mosi, Batu and Dabooto.

It was not until I had gone some distance up the trail leading to the village, however, and had passed under the Azang Pau, the phantom barrier of palm fronds, under which all must pass to cleanse them from any evil intentions, that I was finally greeted by Kanapé. This handsome specimen of dignified manhood was resplendent in his ceremonial regalia, which included a silk top hat, a drum major's baton and a silver plaque hanging from his neck, upon which was embossed the arms of Dutch Guiana, the official badge of his office, given him by the Government. Some of these insignia still in possession of the tribesmen date from shortly after the signing of the peace in 1761.

Primitive formality

The greeting, which never varies, is somewhat as follows:

"Odio Bahkra fy you deh, b'a" (Howdy, white man. How are you, brother?)

"Havu so, Granman, fy you deh, B'a" (So, so, Granman—How are you, brother?)

To which he replies: *"Havu so."* (It does not do to claim that one is feeling too well, otherwise the enmity of the spirits might be incurred.)

"We meetee baka" (We meet again).

"E-yah we meetee baka" (Yes we meet again).

I then proceeded as follows: *"Granman—Dissee wan muy condree"* (This is a fine village).

"Ala you suma deh muy tumussi" (All of your people are very nice indeed).

To which he replied: *"E-yah Bahkra datti Bon"* (Yes, white man, that is good).

He then motioned me to follow him to the *Krutu Oso* or Council House and we were soon comfortably seated on the carved ceremonial benches surrounded by the Captains and other dignitaries of the tribe while the outside walls of the large hut were almost completely surrounded by villagers. I then proceeded somewhat as follows:

"Granman I have come a long way to your country, many days and nights on the white man's big boat I have travelled—many days of travel on your rivers. I do not come for gold, I do not come for lumber, I do not come for the sap of the wild rubber tree, nor yet do I come to tell you stories of religion or to try to change the God of your people. I come only to make an inspection of your people for a certain illness and to help them in any way I can. I would also like to take a few photographs and collect the beautiful wood carvings made by the Bush Negroes, so that the people of my country can see how the people of your country live, and what beautiful things they make."

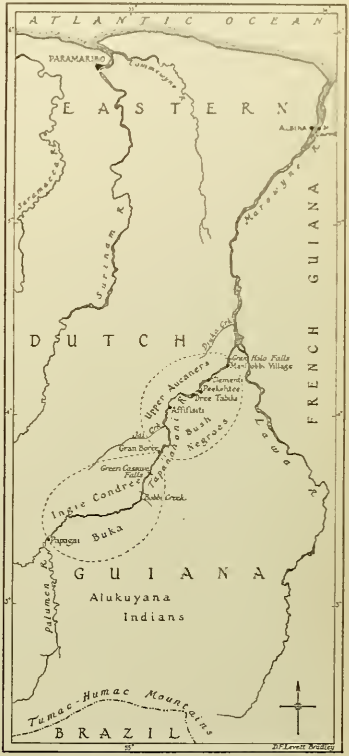
At this point, I passed around several photographs taken on previous expeditions. These were received with many exclamations of amazement, especially since some of the persons in the pictures had since died.

Kanapé then turned and looked me full in the face, saying, "White man I can see by your eye that you tell the truth." He then turned to the assembled Captains, and said: "You see the white man and you have heard him talk. He is not a stranger among us but has come to our people before. He has also travelled in the land of other tribes of Bush Negroes. He knows the Paramacca, the Boni and the Saramaccaner. You hear what he says, he wants nothing from us, but works to do us good. He wishes to go among the villages of our people, even to Gran Boree, the very farthest village of our nation. What is your pleasure?" etc.

"This white man is all right"

After each few words, Kanapé would pause and listen to the exclamation of his council. Such phrases were forthcoming as *"E-yah Granman"*—*"Datti Bon"*—that is good; *"you tahki true"*—you speak the truth; *"Kwet-Kwetti"*—not at all; *"Dissee Bahkra Dehbon"*—this white man is all right, as well as other nasal and guttural exclamations of an affirmative nature. The *Krutu* was finally ended by permission being granted to me as signified by all of the Captains clapping their hands in unison and nodding their heads.

Anticipating favorable judgment I had already begun to unpack my medical kit and had the necessary material ready for the purpose of making tuberculin tests, and also for extracting blood. I then said: "Granman since you are the head man of this tribe, it is only fitting that you should be the first to receive these tests." He demurred for a few seconds but being surrounded by the chief Captains, it, of course, would not do for him to show any signs of cowardice. And more or less to simplify matters, I gently seized his arm, rubbed it with alcohol, and applied the tuberculin test. A necessary sample of blood was obtained in a similar manner. As I was performing the


ATLANTIC OCEAN
PARAMARIBO
ALBINA
EASTERN
DUTCH
GUIANA
FRENCH GUIANA
Suriname R.
Dyuka Cr.
Gran Holo Falls
Manlobbi Village
Clementi
Peekehtee
Dree Tabiki
Affiflaiti
Upper Aucaners
Tapanahoni R.
Bush Negroes
Jai Cr.
Gran Boree
Green Cassava Falls
Ingie Condree
Bubbi Creek
Papagai
Buka
Palumen R.
Lawa R.
Alukuyana Indians
Humac Mountains
Tumac
BRAZIL
D.F. Levett Bradley

REGION VISITED BY DR. KAHN

test on Kanapé the entire council laughed in high amusement and after that it was a simple matter to make similar injections on practically the entire tribe.

Without going into the theories involved, it can be said that the tuberculin test shows the Bush Negroes to be remarkably free from infection with the tubercle bacillus. They stand a marked contrast in this respect to the North American Negroes, their blood brothers, who show relatively high infection. This is especially interesting in view of the fact that the ancestors of the Bush Negroes came into contact with tuberculosis in the days of slavery, for it may indicate that life in the natural state, coupled with their isolation has enabled these people to throw off any manifestations of the disease which their forebears might have picked up.

Mr. Donaldson set about his task and obtained a number of most interesting motion and still pictures. Mr. E. W. Rogalli was of inestimable aid to both Mr. Donaldson and myself. After completing our work in one village, we went higher up the river to the next one and then on to the next. Opportunity was also taken to enhance the collection of Bush Negro art work now at The American Museum of Natural History, and also to gather further information concerning the life and customs of these people.

In this way, all of the villages of the upper Aucaners were visited. At a few places where the settlements were adjacent, the people from one village would come into the field headquarters which had already been set up in another. And at last we came to the most remote of all the Bush Negro settlements in Dutch Guiana, the village of Gran Boree, high up the Tapanahoni River, past the mouth of the far Jai Creek.

Unknown Indians

Late one afternoon while attempting to do some fly-casting from the shore, I happened to glance up the river and to my surprise saw three canoes coming down. I knew immediately that these were not Bush Negro dug-outs as the construction was entirely different. As the crafts came a little nearer it at once became apparent that the occupants were Indians, and from their appearance quite the wildest looking specimens that I have ever seen. The red men saw me at about the same time. One of them gave a loud guttural command upon which the entire flotilla headed about and paddled full speed up the river from whence they had come.

In friendly pursuit

I dropped my fishing rod upon the rock and ran as fast as I could up the jungle trail to the village. Although I had seen the Caribs and Arawak Indians, who dwell closer to the coast, also the Akawoi and Wapisianas of British Guiana, it had never been my good fortune to encounter these wild tribesmen of the all but unknown interior, and I did not wish to miss such an opportunity. Fortunately, some of the members of my Bush Negro crew were about, and the story which I told as rapidly as possible was greeted with loud laughter. "Of course they ran away, they are very much frightened of white men. They call white men 'Panacheeree'—or those who kill their friends. They call us 'Micolo,' their name for Bush Negroes. Most of them have never seen a white man before but have heard some very bad stories about them. They are members of the Alukuyana tribe. Their country begins four days paddle from here at the mouth of the Palumen River (which drains into the Tapanahoni) and extends up the Palumen for many miles. The region between this village and the mouth of the Palumen is known as 'Ingie Condree Buka,' the mouth to the Indian country—no one lives there, so it was agreed upon many years ago by our chiefs and theirs. We will paddle after them with presents and try to induce them to visit you here. If they come be very gentle and do not make quick movements. Go to your hut and wait. If they come, give them rum and cigarettes, which they will like."

With these proud instructions in mind, I sat patiently at the door of my hut, but it was not until about 9 p.m. that I was able to make out a few dim figures crossing the village clearing. These proved to be Moiman and N'angoto, two members of my Bush Negro crew, each leading a stalwart red man by the hand, much as one would lead a child. I arose slowly from my camp chair and extended my hand to each of the Bush Negroes, and then to the Indians, who seeing what was expected of them shook it limply but gravely.

These men were entirely nude excepting for a loin cloth and necklaces and bandoliers of animal teeth and shells. Each carried a bow some 5½ feet in length with arrows of nearly equal length. The heads of the arrows were made of hard wood and, as afterward proved to be the case, were poisoned with curare. They had long black hair, extending well over their shoulders, while their bodies and faces were painted with red, green and yellow pigment. One must admit that such specimens would satisfy any small boy's idea as to what a real wild Indian should look like no matter how hard to please such a boy might be.

After the refreshments had been passed about, the tension seemed to ease considerably and the Indians seemed much interested in examining my clothes, skin, and the various pieces of camp equipment which were about. The next morning about 11 o'clock, seven more Indians came into our camp and from that time on we had little difficulty in making them feel at home. Larger bands were encountered by us when we proceeded up river some distance beyond Gran Boree to hunt fresh meat. This journey took us considerably beyond the Green Cassava falls, and to the mouth of the Bobbi Creek.

A no-man's land

The Indians come down to the remote Bush Negro villages to trade hunting dogs, bows, arrow shafts and feather work, for knives, machetes, cloth and sugar, which filter back into the Bush Negro country from the trading post of Albina, near the foot of the Marowyne River. Curiously, while the Bush Negroes are expert wood carvers they have not been able to make a bow which they consider comparable to those made by the Indians. The hunting dogs which look like a combination of hound and smooth haired fox terrier, are very highly prized and command a large price.

There is considerable traffic on this remote border, where red and black men meet. While the Indians cannot speak the "talkee-talkee" language of the Bush Negroes, nor do the Bush Negroes speak the Alukuyana dialect, they have developed a language known as "Mocks-Mocksie," in which a sign language is aided by a few words from both tongues.

One day while sitting outside of my hut, old Kanapé came to me with a spear having a blade of hardwood 14 inches long and two inches wide at its widest part. The shaft of the spear was broken.

"You see this, Abentee (my Bush Negro name)," said he. "Just last year three Alukuyana Indians brought this down to me, the blade was covered with blood. The shaft of the spear was broken as you see it. This was a message from their chief to help them in their war against the Trio Indians. Those Indians! Their temper is quick and their head is hot. They fight each other for the least little thing. The Alukuyana and the Trio have war one against the other, and then sometimes after peace has been made both combine to fight the Saluma or Diau tribe, who live even beyond the Trio country. It is seldom that all tribes are at peace, but sometimes that is so. All the tribes are friendly with my people, and even in time of war a Bush Negro can go among them without fear of harm. Often I send my most able statesmen to make peace among them but many moons do not pass until some stupid minor incident causes hostilities to break out anew. This has been going on as long as my people have been on this river. In the early days, we also had our trouble with the Indians, but they soon found out that they were no match for us."

In these words you have a summary of the attitude of this group of Bush Negroes to the tribes of redmen who are their neighbors. The white man plays no part in this unusual borderland between two races.

The lost Redfern

It was in this part of South America that the gallant young aviator Paul Redfern has been supposed to be living. It may be of interest to recount some of the information I gathered concerning his possible whereabouts. As will be remembered, Redfern took off from Brunswick, Ga., in the summer of 1927, in an attempt to make a non-stop flight to Rio de Janeiro. There is no question but that he took fresh bearings from a ship off the coast of Venezuela, and there is good reason to believe that the aeroplane which was heard going over mission stations in British Guiana shortly afterward was Redfern's. After that nothing more was heard. Many reports have since filtered out from the interior of a white man living with the Indians and Redfern's brave father has never lost hope of his son being alive and some day being restored to him. Some claimed to have actually seen Redfern in this or that Indian village, while others claim to have found pieces of aeroplane wreckage, wing fabric, the hat of the aviator, etc. As far as I am aware, none of these reports have been substantiated.

In view of the fact that my expedition was within a very short distance of the Palumen River in the upper country of which Redfern was last reported to be located, I took particular pains to ask the Indians who inhabit this region, also certain Bush Negroes who visit the Indian country, of the possible whereabouts of a lost white man. Their response convinced me that the possibility of a white man being in the very far interior is not entirely remote but whether such a person will prove to be the missing aviator is quite another matter.

Various reports

In the village of Dree Tabiki, I saw and spoke at great length with the Bush Negro Kau-flay, whose name has appeared in the news in connection with Redfern. Kau-flay went to the end of the Palumen River and walked twenty days further into the Indian country. He saw and spoke with the Indian Chief Sapuconu, in whose village Redfern had been reported to be. Sapuconu told Kau-flay that he had heard of a white man falling out of the sky and that such a white man was reported living with Indians even further in the interior. Sapuconu himself had never seen this man as has been reported. I also spoke at length to Negro dog traders, namely Payé (Paje), a most intelligent chap, and Captain Tattoo, who had accompanied me on a previous expedition. They had penetrated far into the Indian country from different directions. They encountered numerous Indians of the Alukuyana and Trio tribes, all of whom had heard the story of the white man but none of whom had actually seen him. It was my good fortune also to speak with Mr. M. A. Melchert who is in charge of the most remote mission station in Dutch Guiana. It was to Mr. Melchert that the Indian Kopan first told the story of a white man living in the village of Sapuconu. As has been indicated, this rumor later proved unfounded.

It was from an Alukuyana Indian by the name of Awaimat, whose home is on the high Palumen River in the village of Tulu that I received the information about this white man who may be Redfern, that I considered the most authentic. Awaimat told me that his brother had actually seen this white man living in the village of Asunanga in the country inhabited by the Saluma (Saloma) tribe of Indians. This territory is on the western side of the Tumac-Humac Mountains across the Dutch Guiana border in Brazil. It is on the Hona-Wau Creek near the source of the Trombetas River, which finally drains into the Amazon. Awaimat appeared to be a man of about 45 years of age. He seemed to be in command of his band of men and impressed me as a reliable person and of good judgment. He stated further that this white man had fallen from the sky, and as he made the appropriate gesticulations he also made a noise like the humming of an aeroplane motor. Awaimat said that this white man's legs had been injured, but are now healed. Awaimat also stated that if the Saluma Indians saw white men coming they would be very liable to move even deeper in the interior. It is my impression that an attempt to reach this wild region, most of which no white man has ever seen, would be highly impractical if penetration were attempted from the Dutch Guiana side. It would seem more reasonable to reach the Hona-Wau Creek by going up the Trombetas River from the Amazon.

Two search parties

The stories I heard made it clear that if Redfern is among the Indians they are not treating him as a god, but do recognize that he is a white man. There are two expeditions now in the field to determine his possible whereabouts.

My expedition, which was conducted under the auspices of Cornell University Medical College, the American Museum of Natural History and the National Tuberculosis Association, penetrated this shadowy region primarily for scientific purposes. And the problems for investigation here are manifold, for in the entire world there is no other border where wild men of the black and red races meet on terms of aboriginal equality.

Where Black Man Meets Red

Dr. Kahn at the village of Loca Loca making plans for his expedition into the interior of Dutch Guiana: a journey for purposes of medical and anthropological research. The program included tuberculin tests and blood grouping of the little-known Alukuyana Indians and on the Bush Negroes, who dwell far from their original West African home (Below) The two white men who assisted Dr. Kahn on the expedition: Mr. E. W. Rogalli of the Dutch Guiana Government Service, with thirty years of South American experience back of him, and Mr. Ralph Donaldson, in charge of motion pictures

(Above) Native paddlers: some of the twenty-two husky Bush Negro rivermen who manned the five 40-foot dug-out canoes

(Right) Poling through the tropical rain against a strong current

(Below) Rapids hinder progress throughout the entire length of the Tapanahoni River, the only avenue to the interior

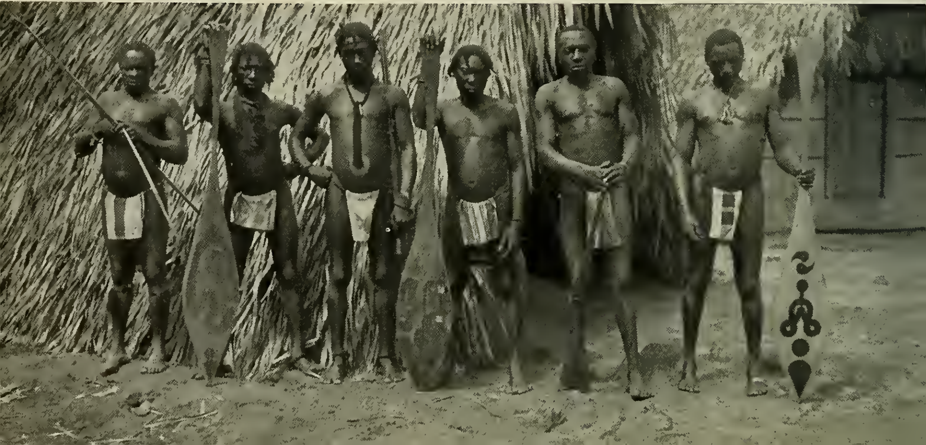
(Above) The flotilla just after leaving Albina, a short distance above the mouth of the Marowyne River. Each canoe had a capacity of half a ton

It sometimes took the expedition three hours to go one hundred feet. Seventeen days of travel upstream took the explorers to their highest point

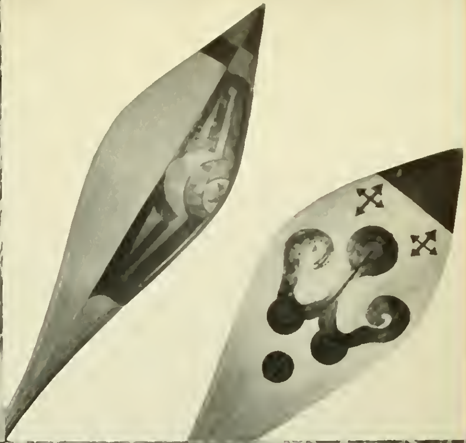
Statuesque figures are common among the Bush Negroes

The Bush Negroes bathe often and are cleanly people. The unmarried woman wears only a short length of cloth, whereas the married woman's dress extends to the knees

Bush Negro rivermen with paddles bearing clan designs

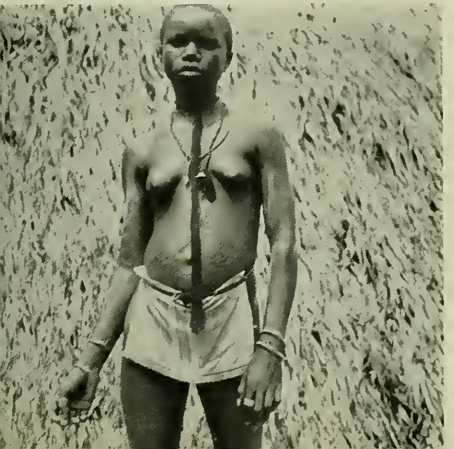


Bush Negro carving a tray out of a section of a tree trunk

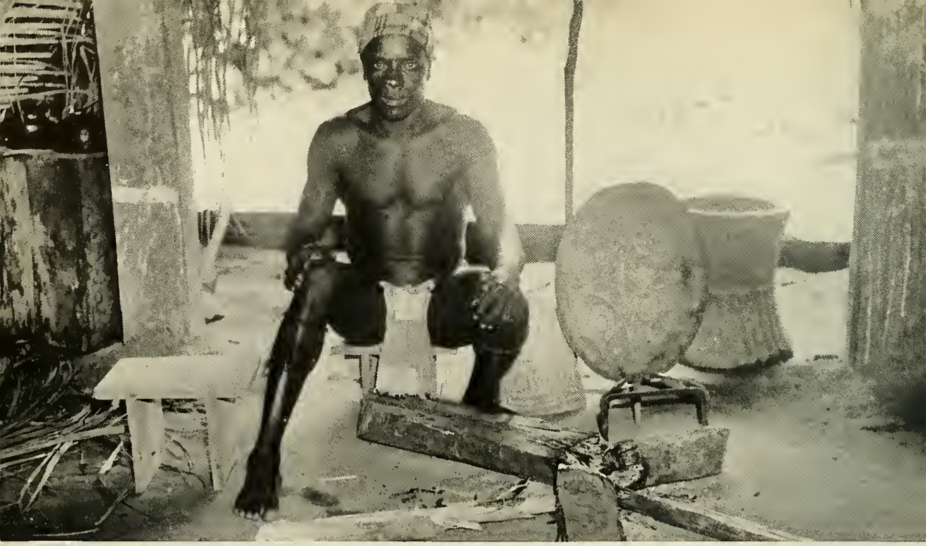


Paddles. The Bush Negroes have a distinctive art which makes use of conventionalized, symbolic designs

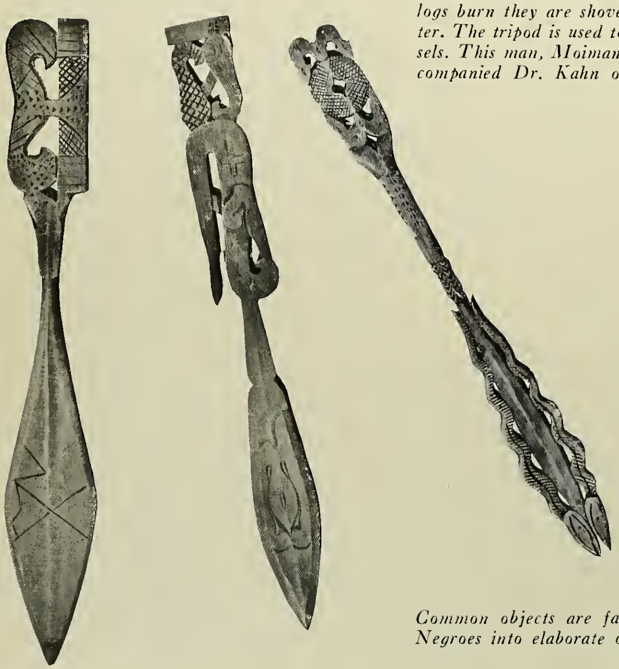
(Above) A woman of the Aucaner tribe. The women tend the crops after the men have cleared the ground. Upland rice and casaba are the chief crops



Ornamentation of the skin by scarring such as the girl at the left shows is a direct West African survival. Both sexes adorn themselves in this way

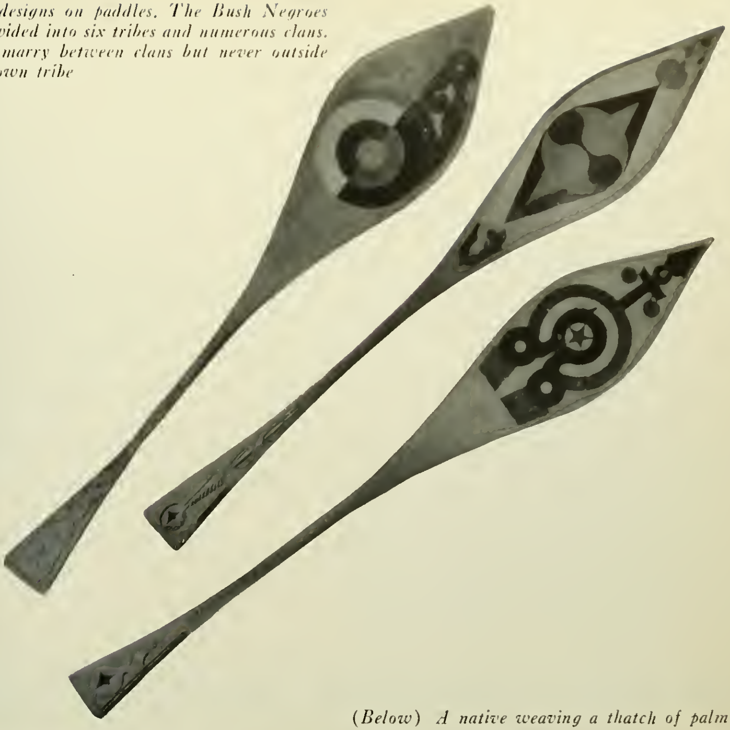


A Bush Negro in his home; beside him are a fire fan, a carved tray and a mortar. As the logs burn they are shoved in toward the center. The tripod is used to support cooking vessels. This man, Moiman ("nice fellow"), accompanied Dr. Kahn on several expeditions

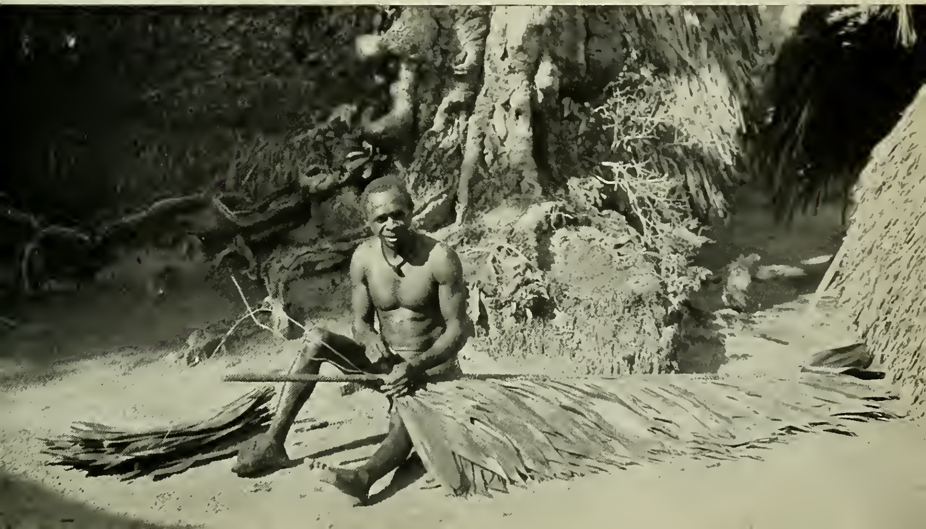


Common objects are fashioned by the Bush Negroes into elaborate objects of art

Clan designs on paddles. The Bush Negroes are divided into six tribes and numerous clans. They marry between clans but never outside their own tribe

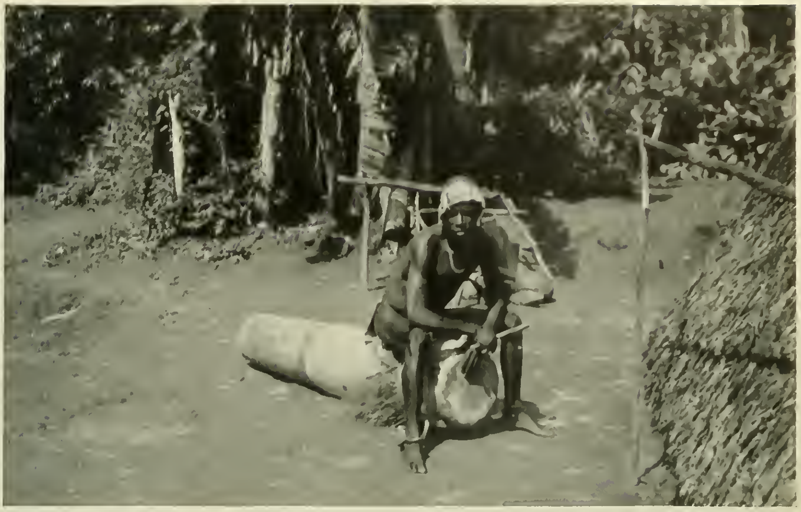


(Below) A native weaving a thatch of palm fronds for his house



(Above) Enshrined fetishes in the village of Gran Boree. It is here that all the sacred objects of the tribe are kept because it is the most remote village of the tribe

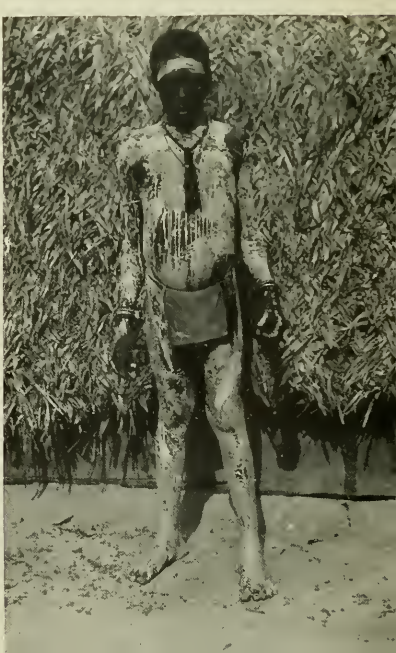
(Above) The shrine to the Voodoo or snake god, the most sacred symbol of the Aucaner tribe. It was only after a long krutu *or powwow that permission was granted to photograph this object*



(Above) Another difficult photograph to secure: a sacred drum, the ageeda, *used to summon the spirit of the Voodoo or snake god*

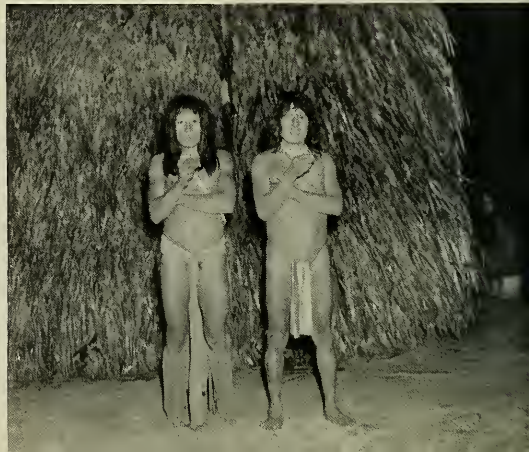
(Below) A member of the remote Upper Aucaners smeared with a sacred white clay that is used by these people whenever they feel the influence of religious emotion

(Left) A harvest dance in a wild section of Dutch Guiana. The anklets are made of Kau-e seeds. The orchestra consists of three tom-toms, rattles (saka), and a board of hard wood beaten with two paddles called quaqua



Dr. Kahn performing tuberculin tests. The tests showed the Bush Negroes to be remarkably free from infection with the tubercle bacillus. Life in the natural state, coupled with isolation, has apparently enabled these people to throw off any manifestations of the disease which their forebears may have contracted while enslaved

New information on the possible whereabouts of the aviator Redfern: Payé, the Bush Negro dog trader, relating the story of the white man who fell from the sky as he heard it from the Trio Indians farther inland



Indians who had never before seen a white man: a flashlight photograph of two Alukuyana Indians. The beliefs and customs of these people are unknown. They live almost entirely by fishing and hunting, and in the latter pursuits even the Bush Negroes acknowledge them their superiors

Dr. Kahn with three Bush Negroes and four Alukuyana Indians (with long hair). This remote section of Dutch Guiana is the only place in the world where wild men of the black and red races meet on terms of aboriginal equality. Many years ago there was trouble between these groups, but today they are on good terms

Three Alukuyana Indians and a Bush Negro. The Indians train dogs for hunting and bring them down the river to trade with the Negroes for knives, axes and machetes. Dr. Kahn's tests on seventy of the Indians showed them to be entirely free from infection with the tubercle bacillus

The Indian who gave Dr. Kahn the most authentic information that may relate to the lost aviator Redfern. Awaimat stated that a white man had fallen from the sky and was living in the village of Asunanga beyond the Tumac-Humac Mountains in Brazil, and that his brother had seen him

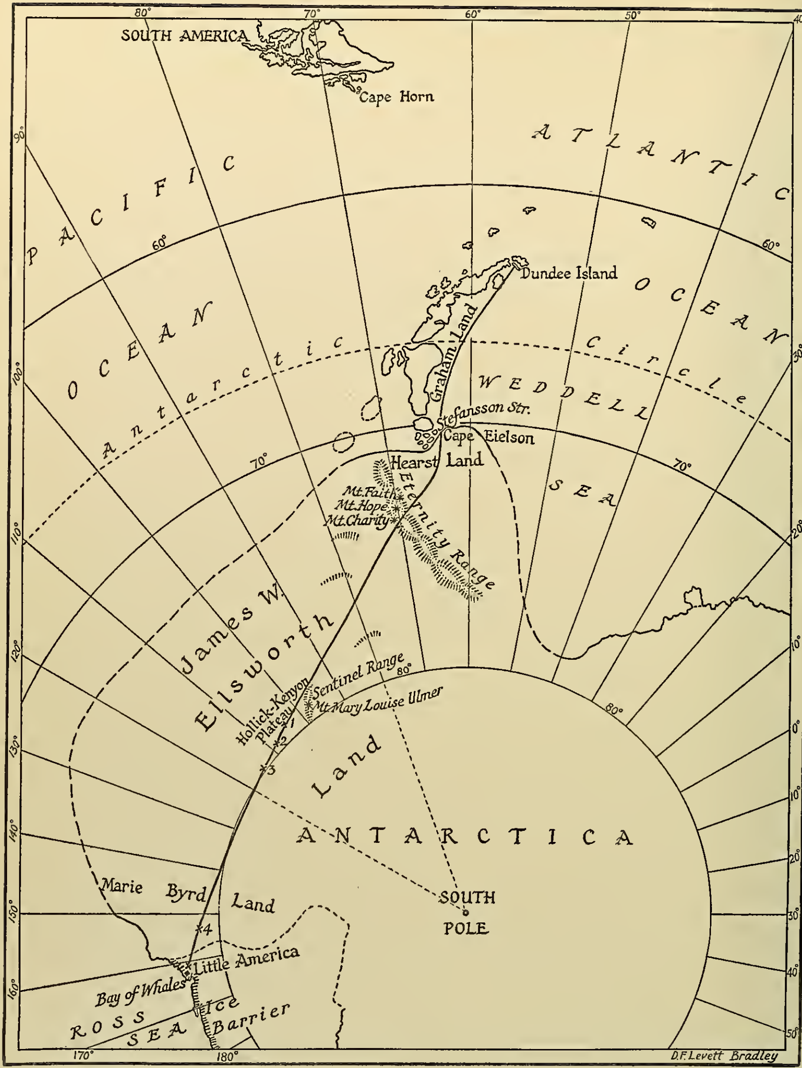
Wide World Photos

LINCOLN ELLSWORTH

Ellsworth's Own Diary

The wonder of discovery revealed in a document that chronicles, minute by minute, the exploration of an unknown world

Date	G.M.T.	Local Mean Time	Remarks
Nov. 23rd	03.00	22nd 11.16 p.m. (Long. 56°W.= $-3^{H}44^{M}$)	Left "Wyatt Earp" at ice edge of Dundee Is. for 500 foot climb to where "Polar Star" stood groomed and ready for trans-Antarctic flight.
Nov. 23rd	08.04	4.20 a.m. (56°W.= $-3^{H}44^{M}$)	Took off in "Polar Star." Headed south following east coast already explored Graham Land. Weddell Sea observed to be quite open to about Lat. 69 south.
Nov. 23rd	12.22	8.6 a.m. (64°W.= $-4^{H}16^{M}$)	Crossed Stefansson Strait. Confirmed Wilkins' discovery of a separation between Graham Land and the Continent of Antarctica, but observed Strait to be not more than one mile wide, which is much less than is shown on maps. Compass bearing of coast S.E. 138° and W. 242°. Low black conical peaks of Cape Eielson on our left. Climbed to elevation of 13,400 feet, temp. minus 22°cent. Heading for the unknown. Bold and rugged mountain peaks across our route lay ahead, some of which seemed to rise almost sheer to 12,000 as far as the eye could see. I named this range "Eternity Range."
Nov. 23rd	14.25	9.45 a.m. (70°W.= $-4^{H}40^{M}$)	Passed three prominent peaks of Eternity Range on our right. I named them "Mt. Faith," "Mt. Hope" and "Mt. Charity." Saw no glaciers or crevassed surfaces.
Nov. 23rd	15.30	10.42 a.m. (72°W.= $-4^{H}48^{M}$)	Mountains beneath us dwindled out into isolated nunataks and merged into a great snow plateau surface with elevation of between 6000 and 7000 feet. Isolated patches of sastrugi appeared at intervals on our right, but no crevasses.
Nov. 23rd	16.15	11.11 a.m. (76°W.= $-5^{H}4^{M}$)	On distant right horizon a mountain range became visible with isolated black peaks which faded out 20 minutes later.
Nov. 23rd	17.00	11.32 a.m. (82°W.= $-5^{H}28^{M}$)	A few more peaks showed on same horizon.
Nov. 23rd	17.20 17.45	11.44 a.m. (84°W.= $-5^{H}36^{M}$)	Mountains 120 to 140 miles distant appeared on our left horizon, also a few peaks on our right horizon.
Nov. 23rd	18.20	12.16 p.m. (91°W.= $-6^{H}4^{M}$)	Very hazy ahead. It was dead flat with a patch of sastrugi on our left. 110 miles further on came a beam of a solitary little range about 75 miles long on our left to which I took bearings. It was symmetrically formed with peaks rising to 13,000 feet. and all clustered into a central mass which dwindled down at either extremity to merge into a plain around. I named it "Sentinel Range" and its central peak "Mt. Mary Louise Ulmer" after my wife.
Nov. 23rd	19.30(?)	12.58 p.m. (98°W.= $-6^{H}32^{M}$)	


80°
70°
60°
50°
40°
SOUTH AMERICA
Cape Horn
P A C I F I C
O C E A N
A T L A N T I C
O C E A N
90°
60°
100°
Antarctic Circle
Dundee Island
Graham Land
W E D D E L L
S E A
Stefansson Str.
Cape Eielson
70°
Hearst Land
Eternity Range
Mt. Faith
Mt. Hope
Mt. Charity
110°
James W. Ellsworth Land
30°
20°
10°
0°
10°
20°
30°
40°
50°
120°
Sentinel Range
80°
Mt. Mary Louise Ulmer
Hollick-Kenyon Plateau
1
2
3
130°
Land
A N T A R C T I C A
140°
Marie Byrd Land
SOUTH POLE
150°
4
Little America
Bay of Whales
160°
R O S S
S E A
Ice Barrier
170°
180°
D.F. Levett Bradley

LINCOLN ELLSWORTH'S FLIGHT, 1935

Between November 23rd and December 15th Lincoln Ellsworth flew from Dundee Island to Ross Sea, traversing an unexplored section of the Antarctic continent. The 2100 mile flight was broken by four landings as shown. Much territory was explored, and the section between 80 and 120 degrees west longitude was claimed for the United States.

Date	G.M.T.	Local Mean Time	Remarks
Nov. 23rd	19.45(?)	1.5 p.m. (100°W.= $-6^{H}40^{M}$)	Fifteen minutes later on south horizon, 100 miles distant, appeared a long black-tipped range which visibly extended through at least one degree of latitude. This appeared to be the last of the mountains we were to see, for ahead and around swept only a vast plateau meeting the horizon in a vista of white. Our visibility on the journey thus far had been from 120 to 150 miles, for we were flying at an average height of 10,000 feet in clear weather.
Nov. 23rd	21.55 (First Landing)	2.59 p.m. (104°W.= $-6^{H}56^{M}$)	Visibility getting low. Landed after $13^{H}50^{M}$ flying and fixed our position as Lat. 79°12'S. Long. 104°10'W. Altmeter showed surface elevation as 6400 feet, and the plateau extended, with slight undulations, in every direction. We stood on the only unclaimed land in Antarctica; in the whole world in fact. With permission of the Department of State I raised the American flag and named this area between Hearst Land on the one side and Marie Byrd Land on the other, or between the meridians of 80° and 120° West longitude, "James W. Ellsworth Land," after my father who made the flight possible. The plateau, above 6000 feet, upon which we were, I named "Hollick-Kenyon Plateau," after my pilot. Remained in this camp till November 24th.
Nov. 24th	5.03 (Second Landing)	—	Took the air again, but landed 30 minutes later in Lat. 79°30'S., Long. 107°55'W., due to low visibility. Elevation about 6400 feet.
Nov. 27th	— (Third Landing) 23.55	11.10 p.m.	Took off and landed 50 minutes later (midnight) in Lat. 79°58'S., Long. 114°15'W., just as such thick weather enveloped us that we could barely see to land. No sooner had we pitched our tent than a blizzard broke upon us. For three days we lay in our sleeping bags trying to keep warm and save fuel. Temp. —5° Fah. This point seemed to be about the end of the level plateau which had extended from the last seen mountains.
Dec. 4th	19.15	11.38 a.m. (114°15'W.= $-7^{H}37^{M}$)	Took off.
Dec. 4th	20.30	11.58 a.m. (128°0'W.= $-8^{H}32^{M}$)	One hour and a quarter later, and about 140 miles after taking off, at an elevation of 4500 feet the plateau, with undulations, seemed to drop towards the Ross Sea Barrier.
Dec. 4th	22.04	12.24 a.m. (145°0'W.= $-9^{H}4^{M}$)	In longitude 145°W. we were over crevasses and 36 minutes later we estimated the surface to be at an elevation of about 1000 feet.
Dec. 4th	23.10 (Fourth Landing)	12.57 p.m. (153°16'W.= $-10^{H}13^{M}$)	Landed. Elevation 980 feet, Lat. 79°15'S., Long. 153°16'W. Camped for night. 125 miles from Bay of Whales.
Dec. 5th	—	Early a.m.	Took off.
Dec. 5th	—	10.3 a.m.	"Polar Star" slackened in her speed, and like a weary bird gently came to earth, completely out of gas. We dug trenches for the ski, weighted them down with some of our equipment and then pitched one tent. We knew that we were not far from Little America. One day Kenyon, standing on the wing of the

Date	G.M.T.	Local Mean Time	Remarks
			plane and looking ahead, saw what he thought to be Little America. Yes! There it was, the wind generator coated in ice and a long line of snow-covered objects which must be the houses—and only 4 miles away.
Dec. 9th	—	—	Packed hand sledge with three weeks' rations. We started out wearing 3-foot snowshoes, and well we did, for drawing a sledge over the ice-coated sastrugi surface we never should have gotten any place with ski. The four miles proved to be fifteen, and instead of Little America we came to only a pinnacle of ice in the midst of a huge pressure ridge. We had left the plane without tent or sextant, hoping to find shelter in Little America. Leaving our sledge, we started back for those two necessary items, rested an hour at the plane and then started back for the sledge. The snow was soft and wet and the sun beat down out of a cloudless sky and made us sweat for the first time during the 22-day journey. Because of heavy hauling we decided to sledge by night and sleep by day, but good weather only lasted two days, then turned foggy. For the first two days we travelled west, then north. Kenyon took bearings with his pocket compass and we estimated our speed to be two miles per hour. We would pull for fifteen minutes, then rest for four, and so on we went, calling 6 hours a day's work.
Dec. 12th	—	—	Overcast and misty. We had made 12 miles and I pointed ahead to where a dark streak broke the dull vista of endless white. It could only be one thing—open water—we both agreed. We pitched our tent, intending to reach it next day.
Dec. 13th	—	—	We looked out of the tent to see everything enshrouded in mist. We travelled all day in the direction we thought the open water lay, but it seemed we were never again to get a glimpse of it. At noon we rested. In the late afternoon through the mist we could discern the crest of a ridge, and thought it odd on the flat barrier surface. We hastened our march. We heard what we imagined to be the lapping of waves. We mounted the ridge and looked straight down into the Ross Sea and were standing on the very edge of the Great Barrier. We retraced our steps and camped for the night about a mile back, for the barrier face is always breaking away. We didn't want to be dumped into the sea just as our goal had been reached.
Dec. 14th	—	—	Morning observations put us about 15 miles north of Little America. We had evidently passed it in the thick fog, so back we must trudge. We found later that we had been three miles east of the eastern end of the mouth of the Bay of Whales. The Bay itself had not begun to open as yet, and a wintry scene indeed it looked. We remained in camp all this day.
Dec. 15th	—	—	Followed the edge of the Bay of Whales and reached Little America just 22 days after leaving Dundee Island.
Jan. 16th	—	8 p.m.	"Discovery II" arrived Bay of Whales from Melbourne with relief.
Jan. 22nd	—	5 p.m.	"Discovery II" left Bay of Whales, departed for Melbourne.

The U.S.S.R. in the Arctic

A new page in the history of the North, showing how supposedly worthless lands can be made habitable and productive

By S. S. SHIPMAN

IN September, 1935, brief press dispatches from Moscow reported to the world that four freight steamers had succeeded in linking the Atlantic and Pacific Oceans by voyages across the frozen Arctic.

Two of the vessels, the "Vanzetti" and the "Iskra," made the West to East journey from Murmansk to Petropavlovsk, on the Amur River, while the "Anadyr" and the "Stalingrad" sailed from Vladivostok to Murmansk. All four ships, built in the U.S.S.R. of Soviet materials, carried large cargoes of foodstuffs, clothing, fuel, and supplies for the population of the extreme North. The "Stalingrad," after completing her record-breaking journey to Murmansk, went on to London to establish a new trade route from Asia by way of the Arctic.

A new era

Behind the prosaic words of these reports is a drama of the North—the culmination of years of struggle to open up the Northeast Passage for commercial navigation and to develop the great natural resources of the white Arctic continent of the Soviets. For a veritable continent it is—constituting about 40 per cent of the huge expanse of Russia and an area at least fifteen times as large as France.

It is a drama punctuated by heroic exploits of ice-breaker expeditions, by daring airplane rescues, by tales of little groups of explorers and scientists pursuing lonely vigils, sometimes lasting for years, in remote Arctic outposts. It is a drama in which human courage and persistence, armed with the tools of modern science, have conquered the snow and ice of the Arctic. Exploration and development in the Arctic today, backed by the resources of the State, bear the same relation to the largely individualistic efforts formerly traditional in Arctic exploration that the "Normandie" bears to the sailing vessels of the nineteenth century. It is possible that more has been accomplished by the U.S.S.R. in the Arctic in the past ten years than by all other countries together since the beginning of the past century.

Planes aid ships

The manner in which the journey of the four freight steamers across the Arctic was accomplished last summer was a practical demonstration of how, by mobilizing the various technical means now available, it has been possible to master the unknown North. Four powerful ice-breakers were stationed in the most difficult sections to convoy the freighters through the heavy ice. Scouting airplanes went ahead to survey the route and relay back to the vessels and to polar stations radio reports on weather and ice conditions. With this assistance the steamers were enabled to navigate thousands of miles of pack, frequently enveloped in dense fog. The voyages, scheduled for five months, were completed in little over half that time.

As a result of numerous such episodes, a new life has come to the Arctic. Where formerly polar bears roamed about and seals crawled over drifting floes, Soviet geologists, explorers, and workers are living, building and making studies. At present about thirty thousand persons of various occupations and callings live and work in the Arctic regions, and the number is steadily growing. Scores of radio stations in the far North transmit to Moscow regular reports of meteorological conditions. Surveying parties have uncovered valuable deposits of coal, oil and metals. Sea and river ports have been built, and new industrial centers created. Dozens of vessels now sail the Arctic waters and airplanes wing their way freely over the uncharted wastes. New islands have been discovered and "blank spaces" on the map filled in. In the words of Rudolph Samoilovich, famous Arctic scientist, "life is everywhere. Like a spring it bubbles in the lands of the Soviet Arctic, and the day is not far distant when the Arctic will cease to be a land of adventure and will become an integral part of the country."

As early as 1919, when the northern regions were still occupied by foreign armies, Soviet leaders were laying their plans for harnessing the Arctic wastes. A first expedition to Novaya Zemlya (New Land) in 1921 was followed by a series of explorations around that island and in other parts of the Western Arctic, especially Franz Josef Land. Another early expedition set out from Belushia Bay, on the west coast of Novaya Zemlya, in July, 1923. The party of four men sailed in a 25-foot boat equipped only with a mainsail and a five horsepower engine. The chief combined the functions of captain, sailor, geologist and topographer. It is interesting to compare this expedition with those of recent years, with as many as 150 scientists and workers in one expedition, commanding all the resources of modern Arctic science and navigation—ice-breakers, planes, radio, etc.

The "Krassin" to the rescue

The first big test for the Arctic forces of the U.S.S.R. was the rescue in 1928 of the hapless members of the Nobile polar expedition from the dirigible "Italia" by the ice-breaker "Krassin."

On May 29, 1928, radio stations in North Russia picked up the S.O.S. of the "Italia." The ice-breaker "Krassin," the largest in the world, sailed June 15 from Leningrad toward the west side of Spitsbergen, from the vicinity of which the radio signals had come. At the same sime the icebreaker "Malygin" was dispatched from Archangel toward the eastern shores of the group. By July 10, the "Krassin," after slowly ploughing through the crushing ice, was within sixty miles of the marooned flyers. Her aviator, Chukhnovsky, in a daring flight over the Arctic wastes, spotted two of the survivors. In his return flight, he was forced down by heavy fog, damaging his plane in landing. Two days later, the "Krassin" picked up from the ice Zappi and Mariano (whose companion, the Swedish scientist Malmgren, had died) and the same day took aboard five more of the Italian survivors. Then the party searched vainly for a third group of seven Italians who had been blown eastward when the gondola broke loose from the ship; effected the rescue of Chukhnovsky and his companions; relieved the Italian group who had made their way overland by dog-team to seek aid, and, finally, carried on a search for the famous Norwegian explorer, Amundsen, who had disappeared in the sea without leaving a trace, somewhere between the coast of Norway and Bear Island.

Northeast Passage in one summer

These and several later expeditions were preludes to the memorable voyage in 1932 of the ice-breaker "Sibiryakov," the first ship to complete the Northeast Passage in a single navigation season. For 400 years scientists and navigators had been trying unsuccessfully to find a short route to India and China through the northern seas. It was not until 1868, that the Swedish explorer, Nordenskiöld, was able to get through this passage at all, after first being compelled, however, to spend a winter near Bering Straits. The only expeditions to make the journey since were those of the Russian Vilkitsky, in 1914-15, who spent one winter in the ice, and of Roald Amundsen (1918-20), who was forced to winter for two years before finally breaking through. The "Sibiryakov" made the passage in two months.

The expedition, under Commander Schmidt, left Archangel July 28. After sailing around the northern shore of Northern Land—the first time that this had ever been accomplished—they encountered heavy ice, sometimes over thirty feet thick. Battling the pack ice, several propeller blades were broken, the engine was put out of commission, and, finally, the propeller shaft broke off, taking with it the propeller. The vessel drifted eastward with the heavy ice floes. When the ice began to thin out, home-made canvas sails were put up, and taking advantage of the favorable winds and the current which she had now succeeded in reaching, the ice-breaker slowly made her way toward Bering Sea. Sometimes in order to make headway it was found useful to cast anchor in the ice and kedge the vessel forward by means of a winch. At times explosives were used to blow up the largest and most unyielding ice masses. Thus, in one way or another, but through her own efforts, the "Sibiryakov" reached open water in the Bering Sea on October 1. This unprecedented journey demonstrated that with proper technical equipment it would be possible to establish regular commercial navigation through the northern sea passage.

As the efforts of Soviet explorers were now directed toward the opening up of the Northern Sea Route for practical commercial purposes, it was decided to repeat the voyage of the "Sibiryakov" with a commercial vessel. Accordingly, the "Cheliuskin," a specially built 4,000-ton freight steamer, constructed with some ice-breaker features, was dispatched from Leningrad on July 18, 1933. This journey, although ending in the sinking of the vessel, proved to be one of the most noteworthy in the annals of Arctic navigation. The expedition was led by Professor Schmidt, head of the Northern Sea Route Administration. Its 105 members included many of the members of the "Sibiryakov" expedition. There were also on board ten women and two children (one of whom was born as the steamer battled its way through the ice of the Kara Sea), making up the families of a party of scientists who were to replace the group wintering on Wrangel Island. By September they had reached Cape Cheliuskin—about midway along the bleak Arctic coast line and the northernmost point of the continent. Twelve vessels were gathered at the mouth of the Lena River, whereas in the entire previous history of Arctic navigation only nine ships had ever reached that remote port.

A miss as good as a mile

At about 250 miles from Bering Straits heavy pack ice was encountered and progress became painfully slow. After 18 days of alternately buffeting and drifting with the ice the vessel was actually in sight of Bering Straits and open water on November 3. But before the last 15 miles of heavy ice could be negotiated a fierce gale blew up and swept the ice masses in which the "Cheliuskin" was caught fast far to the northwest. For three months the vessel struggled against the heavy ice fields and on February 13 a wall of ice thirty feet high crashed against her and split her side from bow to stern. In the two hours that it took the ship to sink, provisions, building materials and supplies and the entire party on board—with the exception of one man crushed by a beam—were safely landed.

Then followed the amazing series of rescue expeditions organized by the Soviet government, by air, land and sea. Airplanes were dispatched from all parts of the Arctic; dirigibles were sent by rail and boat as a reserve; dog-team bases were established at the nearest points along the shore with supplies of food. As a final measure the ice-breaker "Krassin" was overhauled at Leningrad and sent on a 12,000-mile voyage through the North Sea, across the Atlantic Ocean, through the Panama Canal and up the west coast of North America to the Bering Sea. By the time the vessel reached the Canal Zone all of the 104 persons on the ice floe had been rescued by seven airplanes, after a series of spectacular flights in which fogs, blizzards and masses of moving ice on the improvised landing-fields and other hazards were successfully overcome. The women and children were taken off the floe on March 5 but it was a month before other planes could arrive at the scene and make their way to the marooned group. The last six persons were carried to the mainland on April 13, exactly two months after the sinking of the vessel.

Victory out of defeat

The "Krassin" arrived in time to transport the rescued members of the expedition from the Chukotsk Peninsula to the steamers which carried them to Vladivostok on their triumphant homeward journey. Then the ice-breaker headed for Wrangel Island to relieve a party which had been operating the least accessible polar station in the world. This group, including a woman explorer, had been on the island for five years, since for that entire period the ice had been too heavy for any vessel to plow through. While waiting to be carried back to civilization the party put their spare time to good advantage, collecting 2,000 fox skins, 600 bear skins and tons of ivory mammoth tusks.

That summer the ice-breaker "Litke" for the first time in history completed the westbound voyage from Vladivostok to Murmansk in a single navigation season.

The year 1935 marked the turning point from the stage of experimental journeys to that of regular navigation on definite schedules. During that season eighty-five vessels sailed in different parts of the Arctic, carrying cargoes totaling 500,000 tons.

Commerce in the Arctic

The most important commercial voyages are those on the Kara Sea, through which vessels carry freight, principally lumber, from the mouths of the Ob and Yenisei Rivers in northwestern Siberia to western Europe. The Kara Sea expeditions started in 1921 and the volume of shipping has grown steadily from five vessels carrying thirteen tons that year to twenty-eight ships carrying 116,000 tons in 1934. In 1935, forty-five vessels participated in the voyage. These expeditions link up the vast expanses of northern Siberia and their great natural resources with the markets of the European part of the U.S.S.R. and of western Europe The Ob and the Yenisei each extend for a distance of over 2,000 miles from north to south and with their tributaries tap a basin of about 2,000,000 square miles. Until very recently, with the establishment of regular all-year-round air schedules in the northern regions, these great waterways were the only links between the remote Arctic districts and the industrial and trading centers of the U.S.S.R.

The Kara Sea passage has a famous history, dating from the eleventh century, when daring river pirates occasionally ventured on errands of plunder to the mouths of the Ob and Yenisei Rivers. However, as late as the middle of the nineteenth century, the Kara Sea was looked on as an ice-bound prison from which escape was well-nigh impossible. In the thirty years from 1875 to 1905, only seventy-eight freight vessels penetrated into its icy waters. Regular navigation began in 1920 but it was not until ten years later that sufficient knowledge had been accumulated to permit of the publication of the first charts and sailing instructions. The voyages are no longer called "expeditions" but "operations" which, although of short duration—the Kara Sea is open for navigation not more than 100 days a year—have attained the regularity of normal trading schedules. Besides Soviet steamers, ships from many other European countries now visit the new Siberian ports at the mouths of the Ob and Yenisei Rivers. British vessels accounted for two-thirds of the total tonnage in 1934.

Complete mastery of the Arctic route, from Archangel and Murmansk to Vladivostok, will relieve considerably the burden on the Trans-Siberian Railway and give a great impetus to the fur and fishing industries as well as to agriculture and cattle-breeding in the polar regions.

A leading role in the opening up of the Arctic to navigation has been played by the sturdy ice-breakers, which eat through almost the heaviest ice packs. The Soviet ice-breaker fleet, already the largest in the world, is being augmented by six powerful vessels recently put under construction. Four of these will have steam engines totaling 10,000 H.P. each, the same capacity as the "Krassin." Each will have emplacements for three airplanes and catapults to propel them into the air. Two Diesel-electric ice-breakers will have a capacity of 12,000 h. p. each.

Minerals

The army of scientists operating in the polar regions have proved that the Arctic territory, far from being merely a bleak waste of snow and ice, actually abounds in mineral wealth. A recent map shows the location of 273 deposits of useful minerals already discovered in the polar regions, including coal, peat, asphalt, oil, graphite, asbestos, gold, platinum, copper, lead, tin, nickel, iron and amber.

The expanse of dense taiga (forests) and tundras (marshy plains) along the Pechora River in the extreme northern Urals is becoming an industrialized territory. Several coal mines now supply fuel for vessels sailing on the Northern Sea Route and for Archangel and Murmansk. Oil derricks have been built and a new refinery is producing kerosene and gasoline at this most northerly oil center in the world.

At Igarka, on the Yenisei River, a bustling lumber port and industrial center of 20,000 inhabitants has been created amid forest and frozen tundra. To build city and port, work was carried on in winter with the temperature sometimes down to 60 below zero. Now there are sawmills producing lumber for the Kara Sea operations, a fish cannery, a graphite plant, radio and meteorological stations, as well as schools and hospitals. The dreaded scurvy, which created havoc among the population several years ago, largely because the vegetables sent from Krasnoyarsk froze on the way and lost their vitamin content, has now been entirely overcome. Vegetables are now grown in hothouses artificially lighted and heated during the long Arctic winter.

A mushroom city

To exploit the famous apatite (phosphate) deposits of the Kola Peninsula, where a few years ago the entire population consisted of a few nomadic Laplanders roaming the snowy wastes with their reindeer, there has grown up the important industrial center of Kirovsk, with 40,000 inhabitants. For a month and a half there is virtually uninterrupted night, for a month and a half unbroken sunshine. The development of the apatite deposits has not only freed the U.S.S.R from dependence on imports but has converted her into an important supplier of phosphate fertilizer for world markets. In connection with the apatite mines and concentration plants, there has been constructed a 60,000-kilowatt hydro-electric station on the Niva River, the most northerly in the world. Thus the Arctic wastes are beginning to be dotted with towns, factories and ports.

The fish catch in the Arctic has increased from less than 1,000 tons in 1932 to over 5,000 tons last year. Canneries operating in the North now turn out about 2,500,000 cans a year. The seal catch is also steadily rising.

To increase and improve the breeds of fur-bearing animals special nurseries have been established. The most important are on the Commander Islands in the Bering Sea and the scores of islands lying in the vast expanse between them and the mainland. On these islands blue and red foxes, beavers, sables, spotted reindeer, are being bred by the scores of thousands.

For the first time in history large-scale farming is being developed in the polar regions. It has been found that the lack of heat is compensated by the abundance of light. State farms in the Arctic last year cultivated over 6,000 acres of vegetables, including potatoes, carrots, beets, cabbages, onions, kohlrabi, peas, cucumbers and turnips. The anti-scorbutic vitamin "C" is now produced in abundance in the Arctic. Aside from Igarka, hothouse farms have been set up on Dickson Island and at Capes Schmidt and Wellen. Many Soviet scientists are working on the problem of developing northern varieties of plants. Seeds brought from all parts of the globe—from Canada, Alaska and South America—are crossed with the native varieties.

The Kirovsk Polar and Alpine Botanical Gardens, organized in 1932, studies the flora of northern regions. The gardens occupy an area of 3,000 acres, with extensive nurseries and flower beds. So far about 25 types of plants have been found which grow well in the far North, particularly the hardy fruits and berries developed by the famous Michurin.

Farming in the Arctic

The nomad natives of the Arctic—constituting in all twenty-six nationalities—were formerly entirely ignorant of plant culture. For the first time they are now planting fodder grasses and vegetables. This activity supplements deer-breeding, hunting and fishing, tends to adapt them to a more settled existence, and raises their standard of living.

Successful experiments have also been made in the breeding of livestock. Pigs stand the northern climate well, and when they were introduced at Igarka and Anadyr proved quite prolific. At Anadyr the native Eskimos, Chukchi and Kamchadals are beginning to go in for pig-raising and the local cooperative dairy is raising milch cows.

Experiments in cross-breeding the native reindeer have produced a domesticated animal that is in every way superior to the ordinary northern deer. The laboratories of the Leningrad Deer Breeding Institute have produced foods to supplement the moss and lichen ordinarily considered adequate for deer, as these have been found to lack certain nutritive elements. Serums to ward off diseases to which these animals are susceptible have also been prepared.

Almost the year round Russian fliers thread their way to and from all parts of the polar regions. They accompany the Kara Sea expeditions and guide freight vessels on their journeys to the mouth of the Lena River. They participate in trapping and fishing expeditions, locating seal herds and fish schools and guiding the boats through the ice. They assist in geological surveys and mapping operations. They carry mail, freight and passengers on the several air lines that have been organized in the far North in the past few years. About two-score Soviet planes flew a total distance of 875,000 miles in the Arctic regions during 1935—over a dozen times as much as three years before.

New air routes

At present regular airways are already in operation along the valleys of the Ob, Yenisei and Lena Rivers. The 1,250-mile Krasnoyarsk-Dudinka line will shortly operate on a daily schedule throughout the year. Another service will extend from Khabarovsk through Anadyr, Cape Schmidt and across the Chukotsk Sea to Wrangel Island. Planes will make this journey of 2200 miles every ten days and for the first time Wrangel Island will have direct communication with the mainland all year round.

Within the next two or three years it is planned to have a network of mail and passenger airlines tapping the entire Arctic territory. Airplanes will be expected to cover the route from Murmansk and Archangel to Vladivostok, via the Arctic Ocean and the Bering Straits, in sixty hours' flying time.

The opening up of the new air routes in the polar regions was preceded by a series of daring experimental flights over almost unknown territories. The pilot Vodopianov flew from Moscow to Cape Schmidt, at the extreme northeast tip of Siberia, and back—a distance of about 12,500 miles—in 104 hours' flying time. In the last 3000 miles of the flight to Cape Schmidt, the stretch from Khabarovsk, the aviator had to wing his way "blind" through thick fog and mist over the open sea to Okhotsk and over the Anadyr Mountains.

An outstanding flight was made last summer by the pilot Molokov, a hero of the "Cheliuskin" rescues, over northern Siberia and the eastern section of the Arctic. Starting from Krasnoyarsk, Molokov, using a specially equipped giant plane "U.S.S.R.N-2," flew east to Yakutsk. From there the route lay over the towering Kilima Peaks, never before conquered by plane, then north to the Arctic Ocean. For a month and a half the party of six made studies of the ice and meteorological conditions in the East Siberian and Chukotsk Seas. They then flew north of Wrangel Island to a latitude of 73°, the furthest north ever attained by a plane in that territory. It was here that the mythical Andreyev Land was supposed to lie, but Molokov reported that all that could be seen was a vast smooth expanse of ice. The plane covered a distance of 25,000 miles in 250 flying hours during an expedition lasting eighty-nine days, without a single mishap.

Radio plays a no less important part in the conquest of the Arctic regions, assuring every ship sailing the Northern Sea Route of continuous contact with the mainland. When the "Cheliuskin" sank the radio station was dismantled five minutes before the vessel disappeared in the icy sea. Within twenty-four hours the operator, Krenkel, had brought the Schmidt Camp in touch with the mainland, and the constant communication maintained made possible the subsequent rescues.

The aggregate capacity of radio stations in the Arctic was 20,000 watts in 1934, compared with 3050 in 1932. The schedule calls for putting into operation by the end of 1936 additional wireless stations with a capacity of 35,000 watts. There are now over 100 wireless stations in the Arctic and sub-Arctic territories, whereas in 1917 there were in all four radio stations in the Arctic.

Scientific work

Last year about two-score scientific expeditions were sent to the Arctic. Among the forty-nine special expeditions planned for 1936 will be one to study the White Sea herds of Greenland seals; another will study the sturgeon fisheries at Novaya Zemlya, and another will go to the Yenisei region to help develop the raising of muskrats. Over 400 scientific workers, including 150 geologists, will participate in the various expeditions.

An important and fruitful expedition was that aboard the ice-breaker "Sadko" last summer. Its fundamental tasks were to explore the course of the warm currents of the Gulf Stream and to make a hydrological study of the lower depths—two miles down—of the polar basin.

The "Sadko" had been raised from the bottom of the sea, where she had rested for seventeen years, in October, 1933. The expedition spent eighty-five days cruising in polar waters and covered a distance of 7500 miles. Half of this lay north of the 80th parallel. The highest point reached was 82° 41′, setting a world record for navigation in northern latitudes. The scientific observations embraced the territory from the shores of Norway across the Barents Sea, the Greenland and Kara Seas and the entire western part of the Arctic Ocean. The "white spot" on the map of the Soviet Arctic between Franz Josef Land and Northern Land—an area of 14,000 square miles, was filled in. Shallow water was found in the center of this area and one large and three small islands discovered near the shores of Northern Land. The expedition collected many thousands of species of flora and fauna, a great number hitherto unknown; made over 5000 chemical analyses of sea water; took 2500 soundings of the sea bottom; drew up ninety weather charts based on its own observations and on meteorological reports received two or three times a day from other stations; studied the ice-drifts, and mapped more precisely the outline of the coast of North Spitsbergen and other little known islands.

Radio-probes

The stratosphere was studied by means of radio-probes, which are automatically recording instruments sent up in little balloons. The readings of the instruments are automatically transmitted by radio. Thirty-three radio-probes were sent aloft, of which twenty-one reached the stratosphere. This instrument, invented by Professor Molchanov, is one of the most valuable devices for investigating the properties of the atmosphere. On occasions they have reached a height of fifteen miles in the Arctic regions and recorded the temperature and air current conditions prevailing. This radio balloon, which as originally designed weighed about three pounds, now weighs less than a pound.

Ushakov discovered a warm water lane 650 feet wide cutting through previously unexplored territory between Franz Josef and Nicholas II Land. The temperature of the water was 30° F. and Ushakov expressed the belief that it was a part of the Gulf Stream. Should this prove true the discovery may lead to findings of incalculable value to navigation in the northern seas.

The recent discovery by the "Malygin" expedition of six hitherto unknown islands in the center of the Kara Sea was received with great interest in view of a theory held by Soviet experts that at one time the entire territory from the Kara Sea north to Franz Josef Land and Northern Land was part of a continent which sank into the sea, leaving only the tops of mountains above water. The four islands discovered by the "Sadko" expedition are believed to be peaks of these submerged mountains.

Arctic museum

To popularize the scientific and economic achievements in the Arctic, there is to be opened this year in Leningrad the first Arctic Museum. Exhibits will show the natural resources of the polar regions, and display interesting relics, including some objects left by the explorer Barents, who spent a winter beyond the Arctic Circle in the year 1596. These were buried under the snow for over three hundred years. Notes written by Roald Amundsen on his expeditions of 1918-19 also constitute a part of the collection. They were found by Soviet explorers wintering near Cape Cheliuskin last year.

Existence in the Arctic settlements is becoming more livable as the amenities of civilization make their appearance. Each winterer is given a monthly medical examination and special diets are prescribed. As a result, only one serious case of scurvy has developed in the past three years. Hospitals give regular ultra-violet ray treatments as a prophylactic during the long winter night.

A few months ago medical science and radio combined in dramatic fashion to handle successfully a most difficult case of childbirth. The physician on Dickson Island received an urgent message one night from the doctor at far-off Cape Desire, on Novaya Zemlya, requesting advice on a confinement case of a type on which he had had no previous experience. The former, standing at the microphone, gave detailed instructions. Within three hours a radio message of gratitude was received from the happy father. The news spread throughout the Arctic stations and the doctors, radio operators and the mother were showered with messages of congratulations.

Last summer, the Polar Theatre, a troupe of fourteen entertainers, in a tour lasting four and a half months, gave sixty-nine performances. Their itinerary included the decks of vessels in the Kara Sea and at the mouth of the Lena River. Programs ranged from vaudeville to Molière's *Tartuffe*. Costumes and sets were carried in large cases which could be converted into a stage. Some of the performances were given for lumberjacks, hunters and other workers at midnight, without the use of artificial light.

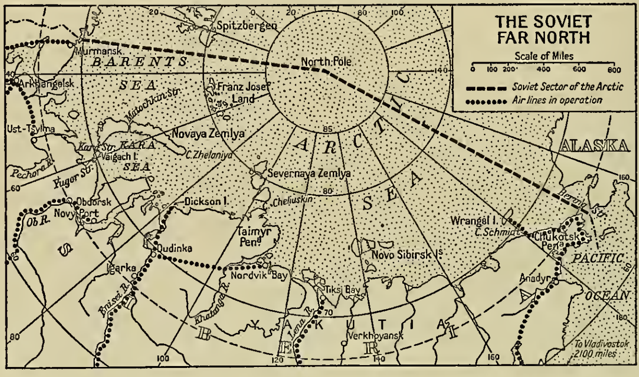
Morale

The varied diversions, the spirit of comradeship, and the never-ceasing activity have done away with the dreaded melancholy, once considered an inevitable concomitant of life during the Arctic night. Svetakov, chief of the winter settlement on Dickson Island in 1934-35, in describing how the gloom and terror invariably suggested by the long polar night were dispelled, said: "Our men experienced no emotional pangs. Scientific and social activity absorbed all our energy. If one commenced to brood or pine, the entire group would endeavor to surround him with attention and care until the mood dissolved. There was little time for loneliness."

Maxim Gorky, in a recent broadcast to 2000 young people who had sent him a collective letter from the Arctic city of Igarka, said: "In the darkness of the polar night the sun of human intellect shines brilliantly." And its light has brought new life to the indigenous peoples of the far North. Doomed to slow extinction from exploitation, vodka and disease, the principal contributions once brought to them by civilization, they have now taken on a new lease of life. Where the population was formerly 100 per cent illiterate, there are now scores of schools, attended by thousands of children. Where the art of healing was the exclusive prerogative of native shamans, there have been established hospitals and medical stations. A few years ago tribes were discovered in the taiga so primitive that they did not know the principle of the wheel. Now the various northern nationalities send their promising young people to study at the Institute of Peoples of the North in Leningrad.

The Arctic yields

In ten years a wilderness inhabited by primitive tribes has been explored and made useful. Where only a few explorers previously ventured, a wave of civilizing influences has created the habitable and productive white continent of the Soviets.


THE SOVIET FAR NORTH
Scale of Miles
0 100 200 400 600 800
Soviet Sector of the Arctic
Air lines in operation
Spitzbergen
North Pole
Murmansk
BARENTS SEA
Arkhangelsk
Franz Josef Land
Matochkin Str.
Ust-Tsylma
Novaya Zemlya
Kara Str.
KARA SEA
Vaigach I.
C. Zhelaniya
Pechora R.
Yugor Str.
Severnaya Zemlya
ARCTIC SEA
Obdorsk
Novy Port
Dickson I.
Cheliuskin
Ob R.
Taimyr Penª
Dudinka
Igarka
Nordvik Bay
Novo Sibirsk Iˢ
Tiksi Bay
Enisei R.
Khatanga R.
Lena R.
YAKUTIA
Verkhoyansk
Wrangel I.
C. Schmidt
Chukotsk Penª
Bering Str.
ALASKA
PACIFIC OCEAN
Anadyr
To Vladivostok 2100 miles
20
0
20
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85
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160
70
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140
160
180

Courtesy of "Foreign Affairs"

The U.S.S.R. in the Arctic

(Below) A pioneer in Arctic commerce: the steamer "Anadyr," one of the four freight ships which in 1935 linked the Atlantic and Pacific Oceans by voyages across the Arctic. All four ships carried large cargoes of supplies for the extreme North. The voyages culminated years of struggle to open up the Northeast Passage for commercial navigation

All Photos by Sovfoto

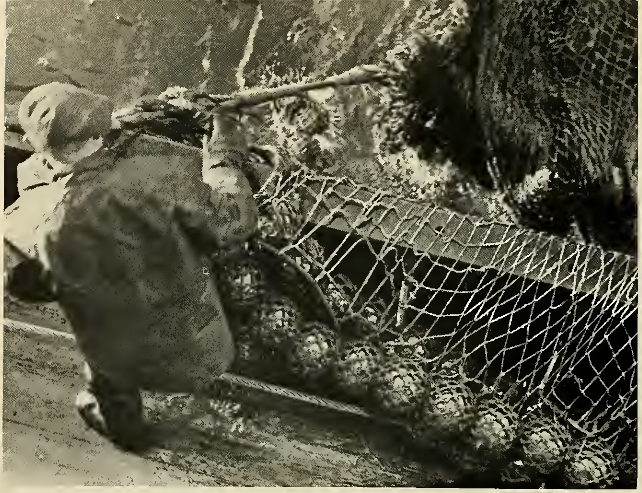
Four powerful ice-breakers were stationed in the most difficult sections to convoy the freighters through heavy ice. The vessel at the extreme right is the famous ice-breaker "Krassin"; next to her is the steamer "Tovarish Stalin," on board which is the Lena-Khatang expedition, whose mission was to found a settlement at the mouth of the Lena

Provisioning the "Sibiryakov" for her memorable voyage in 1932: taking on bullocks which provided meat during the first Northeast Passage to be made in a single navigation season

On board the "Sibiryakov." Professor Schmidt, commander of the expedition, Captain Voronin, Professor Wiese, and T. Azaev discussing plans. After numerous difficulties the "Sibiryakov" reached open water in Bering Sea on October 1

Radio plays a big part in the Soviet program in the Arctic. The above is a picture of the station at the mouth of the Lena River, at 72 degrees north latitude. The operators maintain contact with the nearest cities and with other parties and expeditions wintering in the Arctic, greatly increasing the safety of their exploratory activities

A scene along the route of the "Sibiryakov's" 1932 voyage: crews going ahead to dynamite unyielding masses of ice



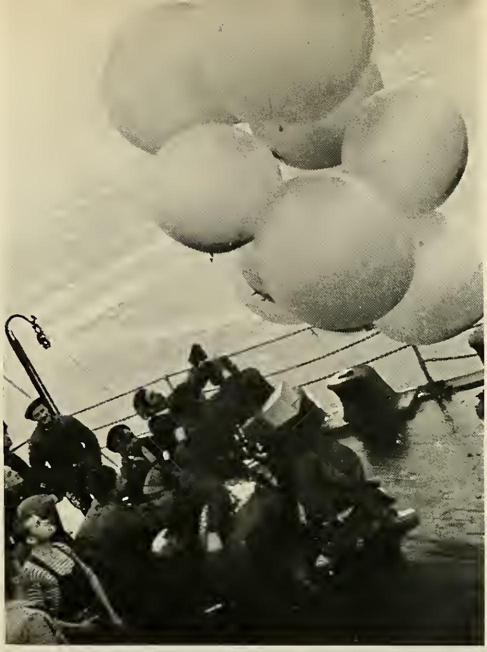
Tapping the resources of the Arctic: a Soviet trawler hauling his net on board. The fish catch in the Arctic has increased from less than 1000 tons in 1932 to over 5000 tons last year. Canneries operating in the north turn out about 2,500,000 cans a year

A catch of seals on the ice-breaker "Sibiryakov." These are the skins, the fat having been removed and placed in special containers. One of the forty-nine special expeditions planned for 1936 will study the White Sea herds of Greenland seals

(Right) Exploiting the rich apatite deposits on the Kola Peninsula, which have made the U.S.S.R. an important supplier of phosphate fertilizer. Where a few years ago only a few nomadic Laplanders roamed the snowy wastes, there has grown up the important industrial center of Kirovsk, with 40,000 inhabitants.

(Above) An unusual application of serotherapy: a veterinary inoculating an ill reindeer

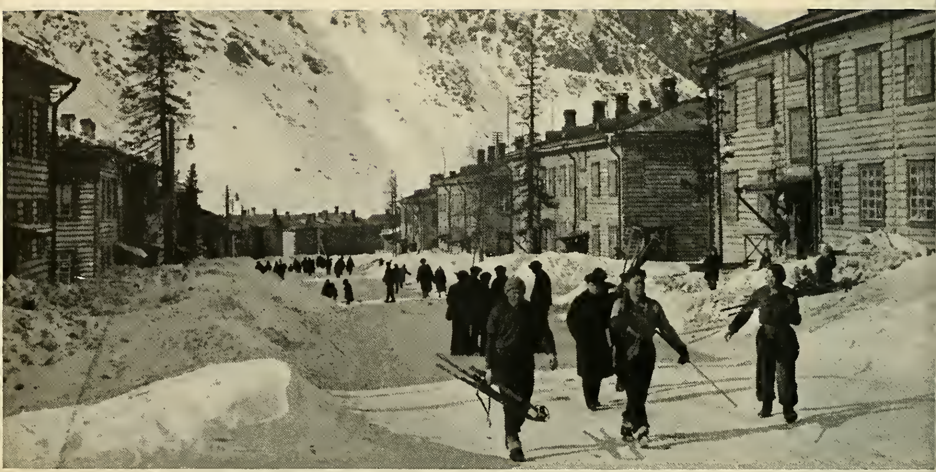
The first wooden house built at the strategic settlement of Ust-Lena ("Mouth of the Lena"): a bakeshop constructed of driftwood



Meteorological work being carried on aboard the icebreaker "Krassin" in the Kara Sea. A so-called radio-probe recently invented by Professor Molchanov facilitates study of the stratosphere by automatically transmitting the readings from instruments that are sent up in small balloons

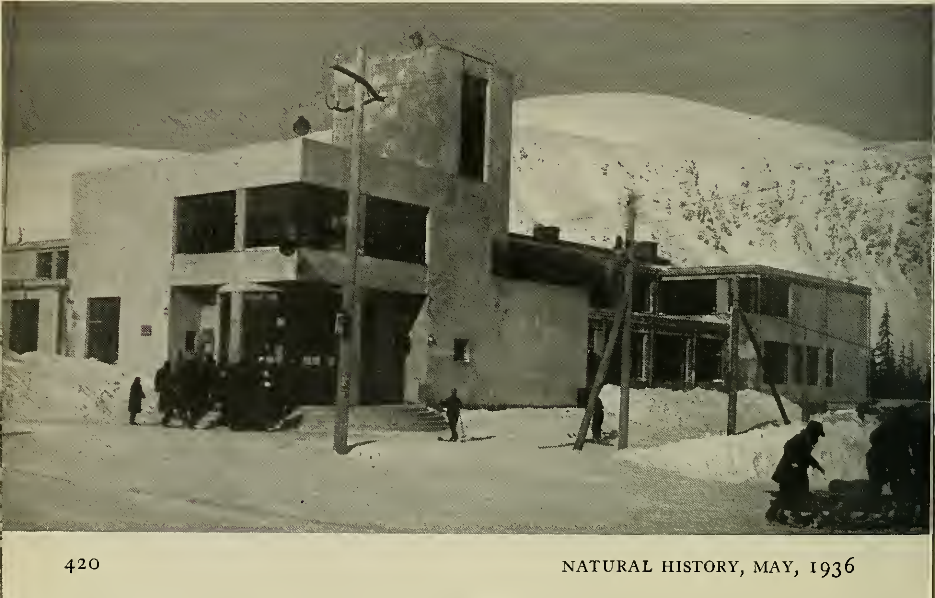
(Above) A scene in a dwelling house in the new settlement at the mouth of the Lena

(Below) A hasty unloading at Tixie Bay, at the mouth of the Lena River. As soon as the Lena-Khatang expedition disembarked, the steamers hurried back to Archangel



(Above) A result of recent scientific exploration: a four-year-old city of 40,000 inhabitants, Kirovsk, north of the Arctic Circle on the Kola Peninsula. The discovery of rich apatite deposits gave rise to this city. New apartment houses are replacing the wooden houses shown in this picture. The 60,000-kilowatt hydro-electric station on the Niva River is the most northerly in the world

(Below) The talking cinema theater at Kirovsk: a reinforced concrete building accommodating an audience of 1200. The city also has hospitals, modern schools and clubs, and is becoming a popular tourist resort for Russians



8000 Miles of Northern Wilderness

An exciting expedition to the Barren Lands, the Arctic coast, and up the swift Nahanni River, which brought back new knowledge of the great animals of the Northwest

By George G. Goodwin
Assistant Curator of Mammals
From the diary of
Harry Snyder

The Harry Snyder 1935 Barren Lands Expedition covered considerably more territory and took us much farther north than the Snyder-Canadian Expedition of the previous year. Like the latter trip it was made possible through the generosity of Mr. Harry Snyder; and much of this narrative is derived from his diary. He not only carefully planned but also led the expedition over 8000 miles of northern wilderness.

Although the first objective of this expedition lay in a region which Mr. Snyder and I have already described in a recent issue of Natural History[1], namely wood buffalo country, an experience which occurred there deserves to be mentioned in brief.

Mr. Snyder was to meet me later at the Slave River when I left Cooking Lake, Edmonton, on July 17, 1935, in a Fokker monoplane. Dense threatening clouds, pelting rain, and flashes of lightning with deafening peals of thunder marked our exit from the civilized world.

Flying in a storm has its own thrills. The wind whistled as the plane, straining at the struts, labored northward over the billowing clouds. I was later to learn that the storm beneath us washed out many miles of railroad, flooded considerable territory, and demolished many villages.

First stop

At 4:00 p.m. we landed at Pine Lake. The following day, accompanied by Mike Dempsey, the head forest ranger, I trailed through the forest north of Pine Lake with the purpose of getting motion pictures of the wood buffalo. Rain fell steadily all day, until about 7:00 p.m., when I located a herd of buffalo in a grove of jack pine and spruce trees. The next morning I left camp at 2:00 a.m., intent on stealing among the buffalo under cover of darkness. Before daybreak I was safely settled in a blind. Occasional grunts from several directions indicated that luck was with me; the animals had not moved away. The long wait until sun-up was a trying period, for mosquitoes swarmed in countless numbers.

I got the first pictures about 7 o'clock. The herd of about thirty animals, mostly bulls, milled restlessly around my hiding place. The hum of the movie camera did not seem to disturb them and through the branches I got some excellent shots; but the first click of my Graflex caused a general drifting away. As the morning advanced their distrust increased, and by 10 o'clock the last of them had disappeared.

Action

I waited until the third day before they returned. This time I was in for some excitement. The herd milled around, rolling in the wallow and rubbing on the trees to rid themselves of insect pests. I patiently waited to photograph a certain big bull. Slipping from tree to tree I approached him cautiously. At the first whir of my camera at close range he wheeled about, faced me and stood motionless. Placing myself against a tree to steady my palpitating heart and shaking knees I continued to run off film. Then suddenly, from directly behind me, came a burst of compressed air, like the escaping steam of a locomotive, warning me of unsuspected danger. I turned my heard very slowly and saw, to my amazement, a curly head and massive horns smeared with blood. A gigantic bull was not more than twenty-five feet away.

The silence that followed was intense. The bull was holding his breath and I remember distinctly that his big dark eyes appeared to be of a deep royal purple. No white showed at the corners, marking him for a genuine wood buffalo. His shoulders scraped the branch of a tree, which later proved to be seven feet from the ground. After a seemingly endless wait he emptied his lungs with a sudden spurt and charged. His huge form lunged forward at an amazing speed. I actually felt a rush of hot air as he hurled himself past me at the other bull. Then, to my relief, both animals passed into the timber and out of sight. Apparently he disdained to bother with anything so insignificant as a mere man when an opponent more worthy of his stupendous strength was at hand.

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[1] "Buffalo Hunt—1935," by Harry Snyder and George G. Goodwin, Natural History, September, 1935.

I had secured a thousand feet of buffalo pictures in the timber and many still photographs. On the salt plains and on the way back to camp I photographed some other animals, including a solitary old bull at twenty feet and a splendid specimen swimming across Pine Lake, with his tail arched clear of the water and his snout, horns, and shoulders just above the surface.

We had to hurry to meet Mr. Snyder at the Slave River. We had thirty-six hours in which to cover a distance of forty miles of forest and swampy muskeg. Breaking camp at six in the morning we found the black flies, bull-dog flies and mosquitoes more annoying as we approached the lower country. We arrived at the Slave River as the sun came up the following day, having halted only once to water and feed the horses. Then we learned that our forced march had been unnecessary. Mr. Snyder did not arrive until evening. He and his pilot, Stan MacMillan, had been forced down twice by storms in their giant Bellanca, and had passed the night at Lac la Biche. Accompanying Mr. Snyder were Col. Steel, government representative, and Jim Ross, outfitter, from Hudson Hope.

To study musk oxen

Our main objective in the Barren Grounds was to secure pictures and make a survey of the musk oxen in the Sanctuary, together with proper recommendations as to the present and future boundaries of the Sanctuary. Leaving a storm behind us we flew eastward over the many islands and intricate bays of Great Slave Lake and landed at Snowdrift where our guide, a Chippeweyan Indian, was to meet us. He was not there. We learned that he and his family were encamped at Lost Channel some seventy miles away. So we flew over there and anchored in the bay. The guide made a spectacular picture standing in the bow of his galley while his eight braves, with long swinging strokes of their paddles, brought him out. After an extensive argument we persuaded him to come with us.

Into the barren grounds

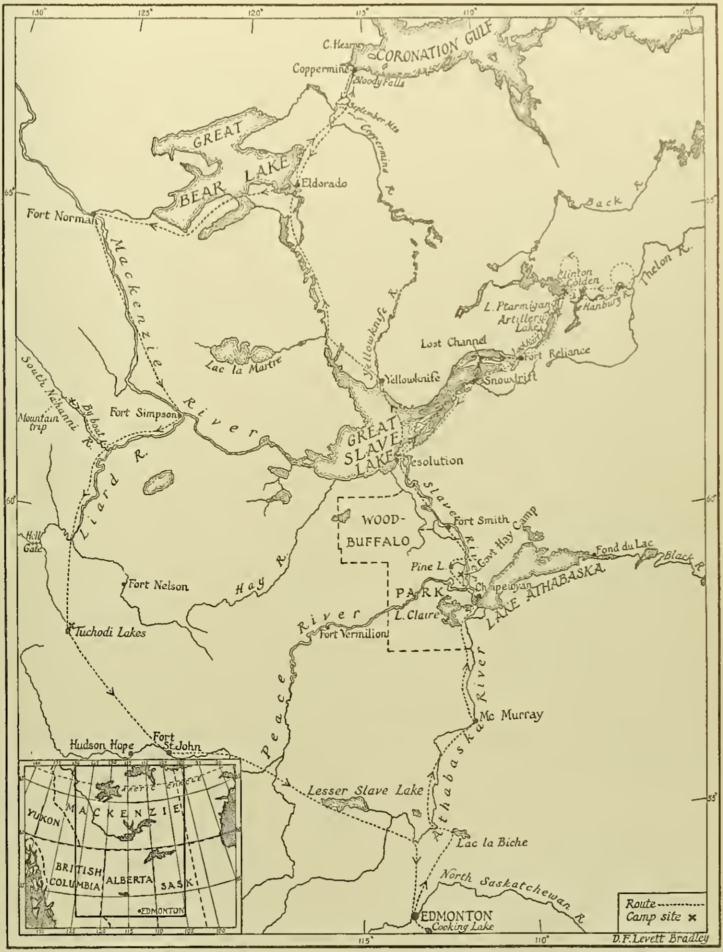
From Fort Reliance, where an ample supply of gas had been shipped in by boat the year before, we followed the Lockhart River and the north shore of Artillery Lake, Ptarmigan Lake, and Caribou Narrows to the great waters of Clinton Colden. As our plane landed in a sheltered cove, two bull caribou left the rocky beach for the mossy hillside and stood silhouetted against the sky. Here we had the most comfortable and pleasant camp of the entire trip. The air was clear and crisp, and no insect pests bothered us.

Our guide, big chief of his clan, proved to be an interesting character. His name, Catholique, has no religious significance but means "rabbit blood." He showed unusual ability in recognizing land marks from the air. When Stan delivered him back to his own village he stated, "I go into flying canoe; I help load with gas, grub, and tents. We fly over the mountains; we fly over lakes; I help carry gas, grub, and tents out of flying canoe—still I don't believe it."

We scouted from the air for signs of musk oxen. Flying over the area north and east of Clinton Colden towards the Black River we were amazed at the extent of bare granite landscape. A few miles south of this area, along the northern boundary of the Thelon Game Sanctuary, the ground was covered with lichens and the edges of some of the lakes with small willows. Not sighting any musk oxen here we continued eastward past Sifton Lake.

It was on the banks of the Hanbury River, near its confluence with the Thelon, that we saw the first musk oxen, a band of about twenty. We could not land in this vicinity, but a small lake farther on proved suitable and we descended to an excellent shelter in a cove surrounded by steep banks.

After the failure of a laborious attempt to approach a second group of animals that we had also sighted from the air, and traveling on foot distances which seemed many times longer than they had from the sky, we spied, later in the day, a lone bull musk ox on a narrow neck of land between two lakes. By crossing two swamps infested with black flies and fording a river which we never suspected was there, we approached under cover to within 150 feet of the animal. He was lying with his back towards us. Our guide skirted the lake and came out twenty-five feet from him. The creature jumped up, raked the sand with its horns and charged. The Indian, a few


130°
125°
120°
115°
110°
105°
100°
65°
60°
55°
C. Hearne
CORONATION GULF
Coppermine
Bloody Falls
September Mts
Coppermine R.
GREAT BEAR LAKE
Eldorado
Fort Norman
Back R.
Thelon R.
Clinton Colden
Hanbury R.
L. Ptarmigan
Artillery Lake
Lost Channel
Fort Reliance
Snowdrift
Yellowknife
Yellowknife R.
Lac la Martre
Mackenzie River
South Nahanni R.
Mountain trip
By boat
Fort Simpson
Liard R.
GREAT SLAVE LAKE
Resolution
Slave R.
Fort Smith
Goat Hay Camp
WOOD-BUFFALO PARK
Fond du Lac
Black R.
Pine L.
Chipewyan
LAKE ATHABASKA
L. Claire
Hell Gate
Fort Nelson
Hay R.
Peace River
Fort Vermilion
Tuchodi Lakes
Athabaska River
Mc Murray
Hudson Hope
Fort St. John
Lesser Slave Lake
Lac la Biche
North Saskatchewan R.
EDMONTON
Cooking Lake
YUKON
MACKENZIE
BRITISH COLUMBIA
ALBERTA
SASK
Route ....
Camp site ×
D.F. Levett Bradley

The Route of the Harry Snyder 1935 Barren Lands Expedition feet ahead of him, leaped over the bank and went headlong down to the lake.

The bull, now fully roused, frequently rubbed his nose on the glands inside his fore legs. I approached cautiously to get some close-up pictures, followed by Colonel Steel with a rifle at his shoulder. The bull made several short rushes toward us but could not quite make up his mind to come all the way. When we were getting so near that retreat would not be possible I asked if he was quite ready with the rifle. He replied, "How the blazes do you take the safety catch off?" It did not take me long to get away to a safe distance.

Back at camp the mosquitoes and black flies were very thick. Realizing the hopelessness of trying to locate animals on foot, we piled into the plane and scouted along the Thelon River and surrounding lakes. Just east of Grassy Island we located a large herd of musk oxen, bulls, cows, and calves. And on the way to the nearest lake we saw another fair-sized herd in a grove. But when we taxied across and landed, the latter herd had completely disappeared. There were no flies, so we did not mind the long trek back to the first band. The musk oxen were still feeding by the lake, and we were able to approach reasonably close. But the dense growth of willows and the necessity of sighting into the sun made photographing difficult.

One old bull musk ox waded out into the lake and swam across. As his heavy coat of long hair gradually became saturated with water, he sank lower and lower. When he approached the opposite shore only his nose and the crown of his head remained exposed. The rest of the herd, sighting us, gathered in a defensive ring formation—this is called "defense carrière"—and then stampeded past us and over the top of the hill. Another herd about three miles away caught our scent and dashed off after the first one.

Plane endangered

Trailing over the last ridge on our return trip, we were amazed to see that both herds had congregated on the beach by the plane. What disturbed us was that the plane, our only communication with the outside world, seemed to be in danger from their rampages, and they could get away without retreating some distance towards us. We hurriedly closed in on them. They galloped back and forth and, finding themselves cornered, plunged into the lake and swam across. One old bull got so waterlogged that he barely made the opposite shore. Two others preferred to take the long trek around the lake.

From our observations, I am inclined to believe that the musk ox is as strong and rapid a swimmer as the buffalo. We counted a total of 171 animals in one tenth of the musk oxen range and concluded that there are approximately eight hundred musk oxen in the entire Sanctuary. Well satisfied with the day's pictures we circled wide towards the north on our flight back to camp. Smoke seen in the distance was explained by Catholique as a signal sent by the Eskimos, but flying directly over it we could see no one. The fire had burned over quite an area but was dying out. Smoke that was seen the previous day had been answered by Catholique, when he and Jim were on the ridge back of our camp. They were definitely answered in smoke signal language, which conclusively proved at that time the presence of the Eskimos.

Back at Clinton Colden the next day our base camp was a welcome sight. Plenty of supplies; and the greatest boon of all, we were free from the host of insect pests.

Treacherous weather

The following day I was to get photographs of the caribou on the shore of Clinton Colden, while Mr. Snyder was to take the plane and scout along the north shore. The morning broke clear and the lake was like a big sheet of glass. We saw three large lake trout tearing chunks from the meat we had put in the lake to keep fresh. Everything looked favorable for a good day. Mr. Snyder called attention to the falling barometer, the pilot climbed a nearby hill for a lookout, and came down in a hurry saying that we had to leave within twenty minutes. In ten minutes the barometer dropped ten points. Suddenly the wind sprang up and before we had half loaded the plane the sun was blotted out by threatening banks of clouds bearing down from the east. A considerable swell rose on the lake, and when we took off we bumped along the tops of the waves before finally rising.

Visibility became poor as the storm closed in on all sides. Tracing the outline of Artillery Lake we raced at less than a thousand feet expecting every minute to make a forced landing. But beyond Lockhart River the weather cleared and we alighted at Fort Reliance beneath a cloudless sky. The following day, however, bad weather again beset us, and the necessity of landing at Resolution on the breakers of Great Slave Lake made a serious problem. After bounding from wave to wave, however, our pilot skillfully eased us into calmer water behind the breakwater. That night the storm increased. Part of the dock was washed away, boats broke their cables, and, to our dismay, the next morning the plane was gone. Both anchor cables had parted. We saw its green and gold outline upon the beach across the bay. Fortunately, the French Padre at the Mission woke us up at daylight and Harry, Stan, and Jim got over to the bay before the plane drifted in and were able to anchor it before any serious damage was done. That storm delayed us three days. It was here at Resolution that Dorothy Snyder and Sam Sackett joined us.

To the Arctic coast

On our trip to Coronation Gulf on the Arctic shore for pictures we followed the course of the Yellowknife River to Great Bear Lake where we spent a week as the guests of Mr. Gilbert LaBine of the great radium mine known as Eldorado. From there we flew across the eastern end of Great Bear Lake, over the September Mountains to the Coppermine River and on to Coronation Gulf. On the road we dodged five snow squalls. A most interesting day was passed at Fort Hearne where Mr. Snyder secured a specimen of Barren Land grizzly killed by the Eskimos last spring at Bloody Falls on the Coppermine. Our next objective was the Nahanni River country, where we hoped to secure specimens of white sheep with black tails.

The Nahanni River flows southeastward through wild country into the Liard which joins the MacKenzie. It is a most beautiful, but extremely turbulent mountain river, with an average fall of eight feet to the mile. In places its current reaches fifteen miles an hour. The average width of the river is about two hundred yards, and its valley is for the most part narrow and passes through a tremendously rugged chain of mountains. In places the valley widens out and shows considerable forested alluvial land. The landscape is a jumble of rough mountains, irregular steep ridges, hills, valleys and ravines.

On arriving at the mouth of the Nahanni we learned that the boat, which had been constructed last year for the express purpose of making this trip, had been wrecked on a trial run. It was a 40-foot craft, carrying two 50-horsepower engines. A snag had been driven clear through the bottom and deck of the boat. Thus the swift Nahanni retains its evil reputation. We had to rent two 28-foot pointer scows from local trappers and prospectors and search for outboard motors downstream as far as Fort Simpson and up and down the Liard. Finally we secured them and started up the Nahanni.

The 140-mile river trip was most interesting. The first fourteen miles above the junction with the Liard was pleasant, the river being wide and deep with only a four-mile current. At dusk we encountered a bad riffle. Mr. Snyder's boat got over all right; but when mine was nearly through it broke a drive pin and we shot back half a mile before we could regain control.

Snags

We had not gone far the second day when we had to line the boats along the shore. Then we arrived at the first "splits." These places, where the river divides into many channels, are characterized by extremely rapid and shallow water. Hundreds of snags and sweepers always harass the traveler just above and below the steepest parts of these rapids. In some places the snags pointed upstream, an entirely new experience to us. Travel was dangerous and most arduous. In some places the water was so swift that lining again had to be resorted to. The "splits" continued for forty miles.

The river wound back and forth across a wide valley, between rugged mountains, and finally carried us toward an isolated group known locally as the Buffalo Mountains. These mountains derive their name from the fact that a small vagrant band of from twenty to thirty buffaloes dwell there, probably having strayed from the Sanctuary.

Just above the Buffalo Mountains we reached the first canyon and the so-called "tropical valley," which in reality is a series of five hot sulphur springs just under the escarpment of the first canyon. This first canyon is a spectacle of indescribable beauty and grandeur.

There were many signs of game, but we were after a particular animal; and from two local prospectors whom we met just below the first canyon, we gleaned an encouraging piece of evidence. The prospectors, George Buda and Joe Clark, from Muncho Lake, B. C., had been up the Flat River and were bringing out some coarse gold. What caught our eye was the pelt of a sheep which they had secured in the canyon. Its well defined black-tipped tail aroused our hopes to a high degree.

Fire

Our navigation problems continued. The gas tank on Harry's boat leaked continually and eventually caught fire. He had thirty gallons of gasoline in his boat, certainly not a comfortable situation in a very rapid river. Near the top of one especially swift riffle between high cliffs, our boat broke a drive pin and we headed straight for a smash against the cliff. Our paddles were shattered when we tried to break the impact against the cliff and the guide's pole shot out of his hands and drifted away. Then with a thud we hit a partially submerged rock and were wedged in with the water pouring over the side. It seemed that at any moment the boat must be sucked under. But she swung around presently and grated along the side of the cliff. Then we headed straight toward a rock in midstream. We hit it, but fortunately broke clear and slipped downstream still afloat. The Indians took the whole incident as a matter of course, but I still believe that we just escaped by the skin of our teeth.

The going continued to be rough right on to Deadman's Valley, which is so named because of the many lives that have been lost there. To us it brought a welcome relief because we could jog along with relative ease. The Gates came as a complete surprise, sheer walls rising 2500 feet on one side and 1500 feet on the other from the water's edge, where the river appears to have cut its channel right through a mountain. Base camp was just beyond the Gates. Two Indians whom we had sent ahead to establish camp assured us that they had seen quite a number of sheep ten miles beyond.

The following day we proceeded to the mouth of Mary River and then inland some six miles on foot, carrying our equipment on pack dogs. Some 3500 to 5000 feet above the river we found the sheep, in the Alpine meadows and on the shale ridges. With Dorothy Snyder on one side of me and Mr. Snyder on the other we came suddenly into full view of the specimens we so much desired, only two hundred yards away. I was able to get some pictures before the animals started to move. Dorothy brought down a big ram to the left and Harry shot another large one on the right. Dorothy, who had started out with only three shells in her rifle, picked out the next two large rams and without missing a shot completed our group of white sheep. The animals were in excellent condition and had, in greater or lesser degree, black tails.

A cold wind brought a chilly rain, and leaving our specimens temporarily we had to retrace our steps for two hours to where we could find timber to stretch a fly and make shelter for the night. Supper that night consisted of roast sheep, which tasted good; but none of us slept much in the cold.

The next morning Jim Ross and I returned to complete the preparation of the specimens. The task of carrying back the heads and hides was extremely arduous, and the distance which we had expected to cover in two hours took us all day. We were all glad to get back to our base camp at the Gates.

The return in the boats to the forks of the Nahanni and Liard was comparatively easy; whereas we had taken five days in the ascent, we shot back down in half a day. The gas tank of our motor still leaked, and with the last spurt of the motor we just made camp.

A mountain paradise

The next day about noon we took off for northern British Columbia to search for stone sheep and the new found elk which Mr. Snyder had located the previous year in this area. At Nelson Forks, clouds hanging over the mountain peaks halted us for a day. Then climbing to about 7000 feet we crossed the range and dropped down to the Tuchodi

Lakes. Tuchodi in Slave Indian means "rough waters." These lakes occupy a beautiful valley extending in a narrow curve for about thirty miles. They range from half a mile to a mile in width and from about seven to ten miles in length. With the exception of the second lake the waters are deep blue and are very deep, but the upper third of the second lake is discolored by glacial silt. The rugged scenery compares favorably with that of Jasper Park or Lake Louise.

A pack outfit met us here, having come 460 miles from Hudson Hope. It was in the high alpine basins or eight miles back from the lake that we pursued our search for stone sheep. After seeing a few animals here and there and getting some good pictures of them we were amazed upon peering over the ridge to see forty-one rams on a ledge at the foot of a high cliff. With the exception of one or two saddlebacks they were all dark blue stone sheep. Three rams were selected for specimens. Dorothy brought one down with a single shot, a splendid example with wide, spreading horns. Mr. Snyder and Mr. Sackett got the other two, both beautiful sheep with massive heads. These alpine basins offer ample conditions for stone sheep, with splendid feed and cover. We saw no signs of wolves here, and there were apparently few bear.

After a day in camp we started across the mountains for the Prairie River country in quest of elk where we had seen them last year. Though the elk were more wary than we had anticipated, indicating that they had been frequently shot at in spite of the restrictions, we were able to make a fair selection and secure our series.

Joe, one of our Indian guides, felt much put out when he had to spend a whole day with me simply getting pictures. Without a gun, the day was apparently spoiled for him; but I secured some excellent pictures of caribou near a salt lake.

Mysterious theft

Back at the camp at Tuchodi Lakes we were mystified by the disappearance of our cache of sheep meat, which had been strung on a rope between two trees some fifteen feet from the ground and covered with a tarpaulin. The rope was broken, all the meat was gone, and the tarpaulin showed claw holes. Our Indians could make nothing of it. Both trees were innocent of any claw marks and to add to the mystery a pile of meat scraps on the ground nearby had not been touched.

Then about 2:00 a.m. the following night I was aroused by the snapping of a branch a few feet back of my tent, and hurrying outside made out the figure of a bear moving between the trees. The Indian advised me against shooting at such close range in the dark. The following day the mystery of the disappearing meat was completely solved. A black bear ambled up to inspect our camp and betrayed his guilt by looking up to see if there were any more hams hanging between the two trees.

While some of us remained in camp to prepare our trophies, Dorothy was in the mountains above the second of the Tuchodi Lakes photographing stone sheep and Rocky Mountain goat on the same hillside only a hundred or so yards apart.

Elk, caribou, moose, and stone sheep find a natural home about the headwaters of the Prairie and Henry Rivers, and in the region of the Tuchodi Lakes. The sheep are extremely numerous, and have ample feed. There are a few goats in the same area, some caribou, moose and grizzly. Three grizzlies were observed but none procured.

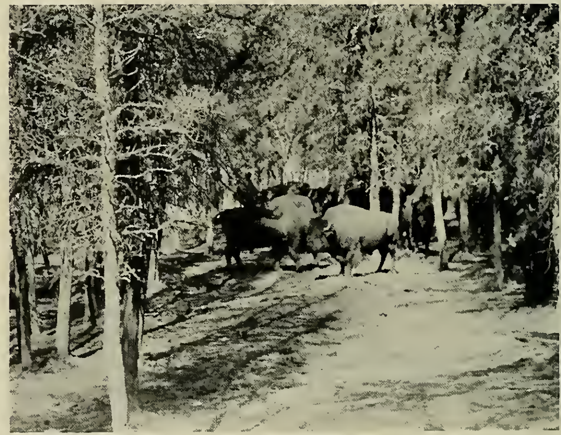
A quick get-away

When the planes for our return trip were two days overdue, delayed by clouds enveloping the mountain peaks surrounding the lake, a clear day brought them swooping down to our camp. We were so anxious to get out before the clouds closed in again, that we loaded up the two Fairchilds and were on our way within an hour. The heavily loaded planes labored over one-half the length of the lake before they could rise. Skimming then over the tree tops we climbed out of the narrow valley in three or four circles. Beyond the high mountain peaks we headed for Fort St. John, and from there followed the Peace River and the shores of Lesser Slave Lake, back to Edmonton.

Our program had covered a vast territory and many objectives, and it was due entirely to Mr. Snyder's keen interest and unfailing persistence in spite of frequent set-backs that each project was carried through successfully.

8000 Miles of Northern Wilderness

Pine Lake, in the Canadian Wood Buffalo Park: the first objective of the Harry Snyder 1935 Barren Lands Expedition, which had for its purpose a study of the great animals of the Canadian subarctic



A photograph of a small and diminishing race of animals: wood buffalo in the sanctuary which has been established for their protection

(Above) Glimpses of unsuspecting wood buffalo in the jack pine and spruce forest of their range. At this season the buffalo rub against the trees to rid themselves of insect pests (Below) An old grandfather of the herd: a formidable subject for the animal photographer

Flying northeastward over Great Slave Lake: a photograph from the plane en-route to the country of the musk oxen

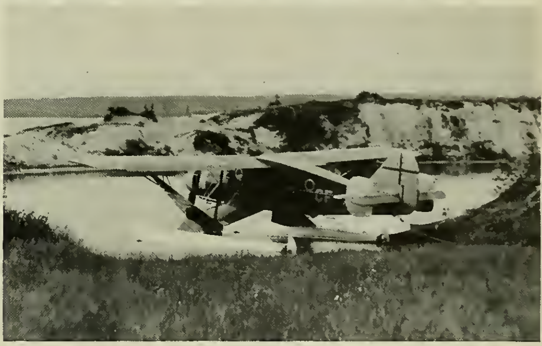
Mr. Snyder, the leader of the expedition, with members of the party and local settlers

(Left) Looking west from the eastern end of Great Slave Lake

A solitary old bull musk ox in the Thelon Game Sanctuary

(Above) On the border of musk ox country: the expedition's camp and plane at Clinton Colden

(Right) A landing near the confluence of the Hanbury and Thelon Rivers, where the party sighted their first musk oxen from the air

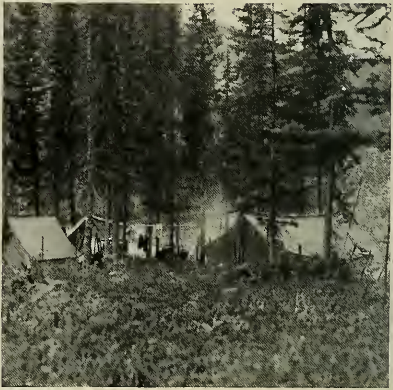


(Right) The wild Nahanni, a beautiful but turbulent mountain river which the expedition ascended in quest of a variety of white sheep with black tails

(Below) Pack dogs used by the expedition contentedly riding the swift water of the Nahanni

(Below) On the banks of the Nahanni River, with a specimen of black bear just secured

(Below) Camp at the Gates of the Nahanni in a forested valley



(Left) The scenic Gates of the Nahanni, sheer walls rising to great heights from the water's edge, where the river appears to have cut its channel right through a mountain

(Below) The boat designed for the trip was wrecked on a trial run, and two 28-foot scows of the type shown here were used

(Below) Tuchodi Lake, in northern British Columbia, a region of rugged beauty

(Below) Preparing the stone sheep trophies and smoking the meat

A denizen of the alpine meadows of northern British Columbia: a yearling ram stone sheep

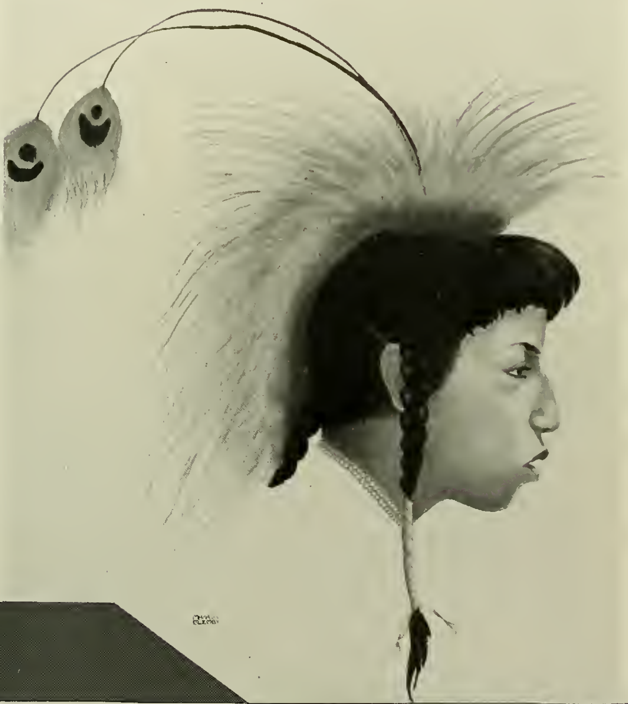
(Above) Harry Snyder, leader of the expedition, and Dorothy Snyder, his daughter, who brought down some of the finest trophies

(Right) The expedition in elk country: along the Henry River, British Columbia

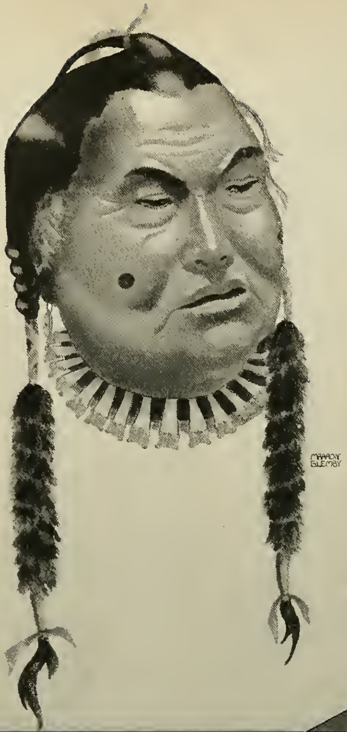
INDIAN TYPES

by

Maaron Glemby

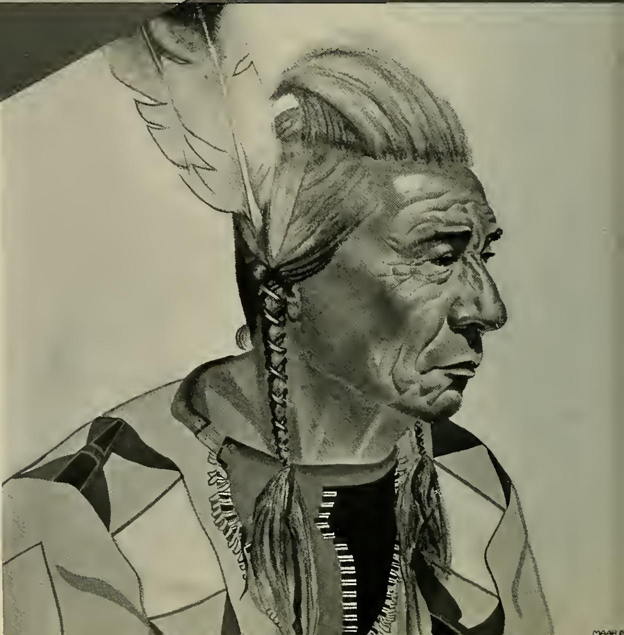


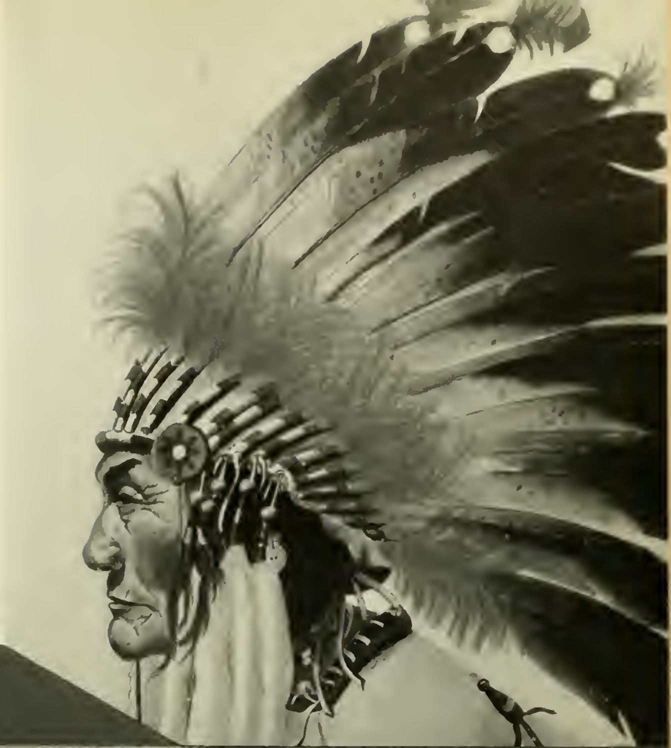
"Dancing Boy," son of famous dancer "Turtle." A Black Foot Indian



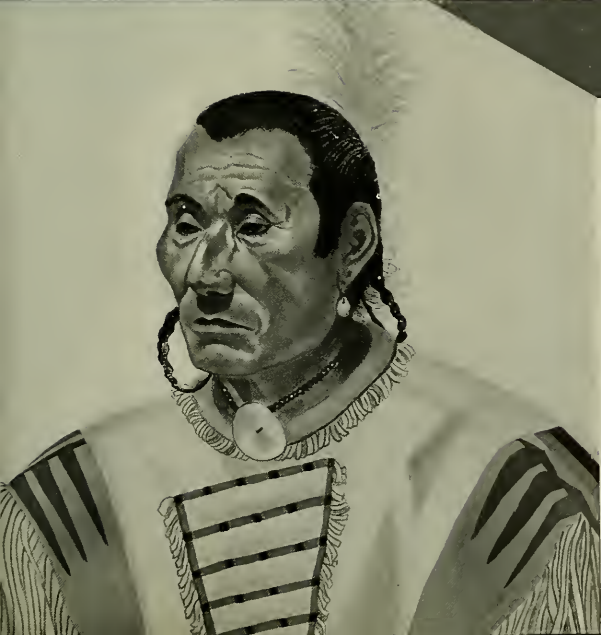
"Short Face," of the Black Foot Reservation, Montana

"Weasel Tail," a Blood Indian warrior of Alberta, Canada, in his late seventies

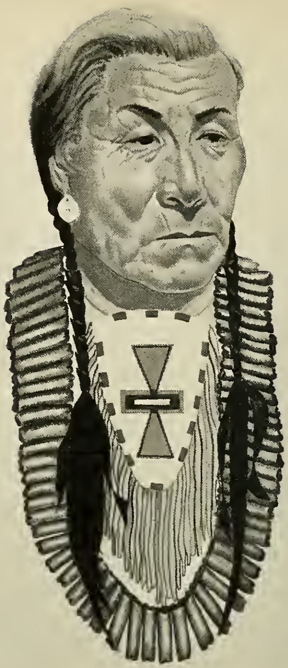




"Bird Rattle," of Blood Indian Reservation, Alberta, Canada

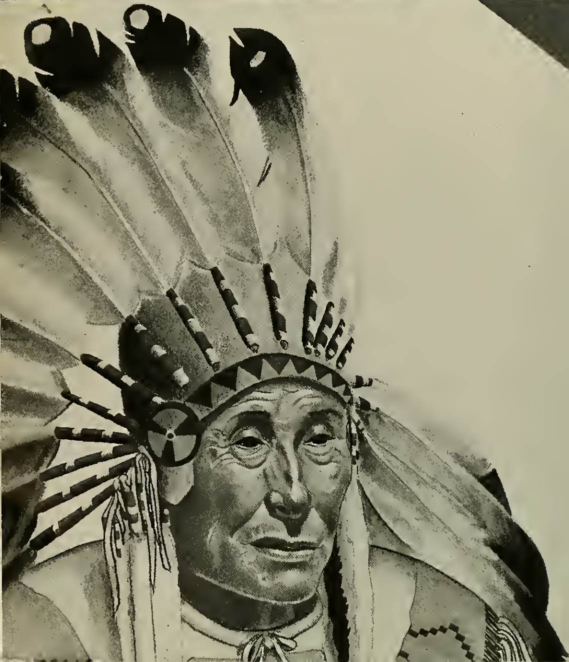


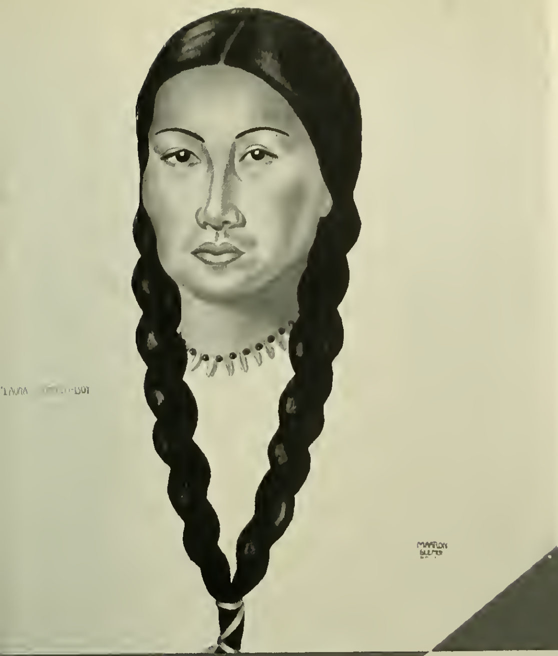
"Body," another Blood Indian



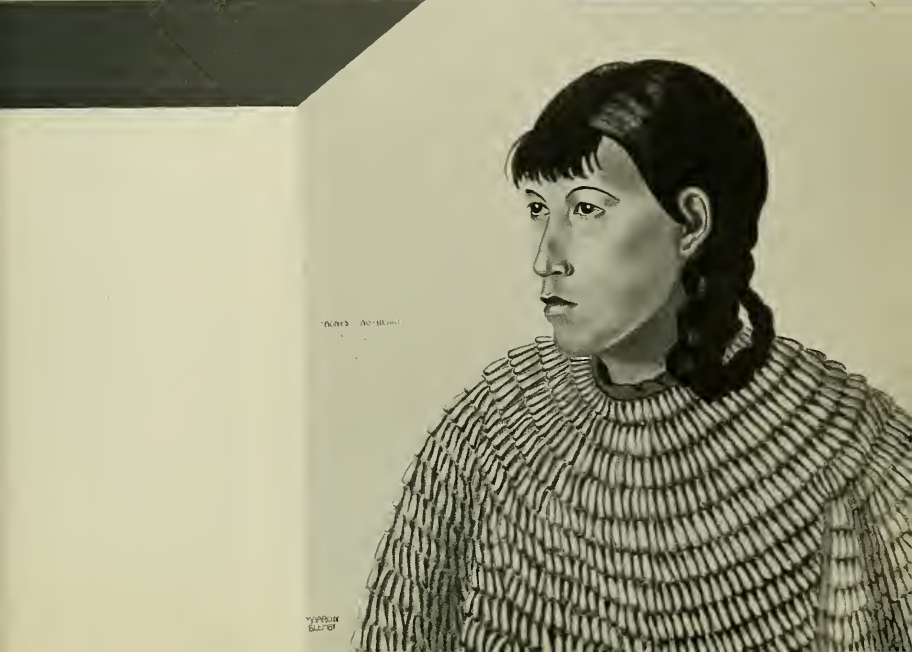
"White Man," a Blood Indian wearing a necklace of deer or antelope ankle bones

"Tall Man," of Blood Indian Reservation, Alberta, Canada

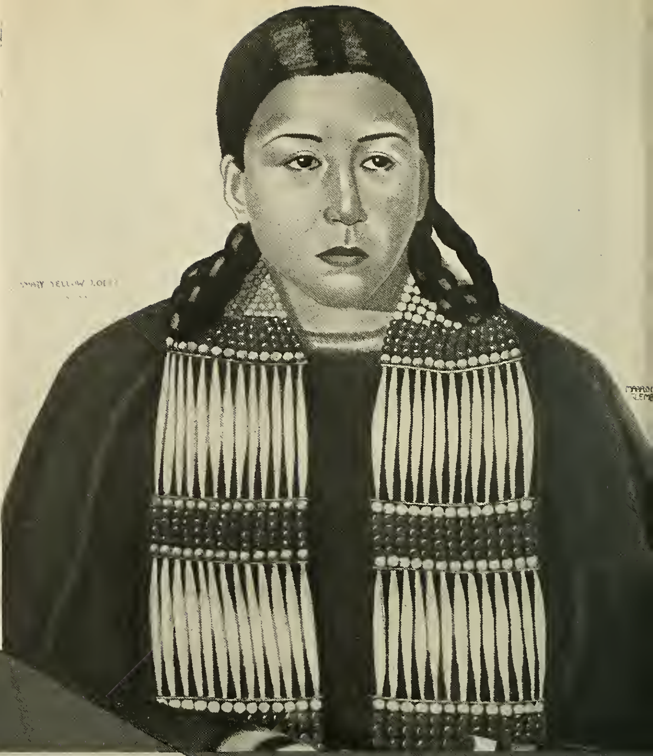




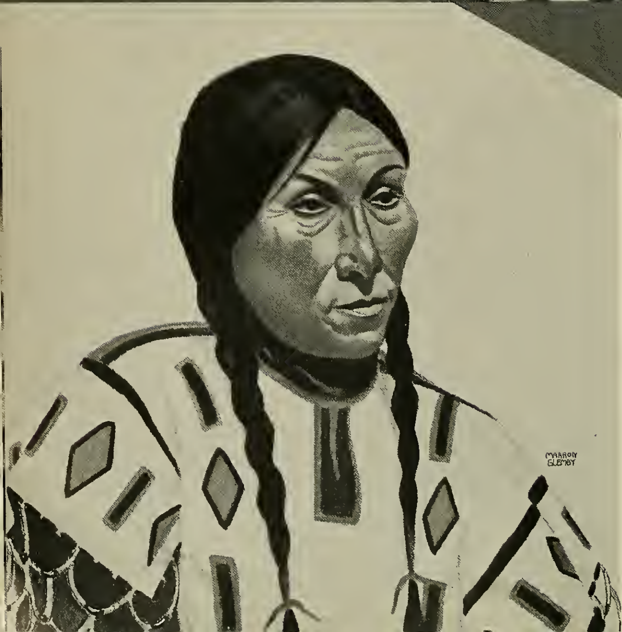
"Laura Buffalo-Boy," Sioux Indian girl of Standing Rock Reservation, North Dakota


AGNES NO-HEART

"Agnes No-Heart," Sioux girl, wearing shell garment handed down for several generations


MARY YELLOW LODGE

"Mary Yellow Lodge," Sioux Indian girl, wearing neckpiece of beads and bones of waterfowl



"Mrs. Percy Creighton," of Blood Indian Reservation, Alberta, Canada

How Insects Protect Their Eggs

Strange ways in which insects provide for the care and feeding of offspring they will never see

By C. H. CURRAN

Associate Curator, Department of Entomology

THROUGHOUT all the stages of their existence insects are particularly subject to attack by enemies, and relatively few of them survive to a ripe old age. In order that they may survive they have undergone many modifications in habits and structure and some of them have developed what are undoubtedly the most marvelous adaptations to be found anywhere in the animal kingdom.

No end of marvels

The discovery of some unusual trait in any of the vertebrate animals almost invariably results in much discussion and expression of amazement—but not so with the insects. The whole insect kingdom is so filled with startling and inexplicable habits that the entomologist no longer is amazed but accepts new discoveries in a most casual way, even though the newly observed practice may be so astounding as to be scarcely believable.

The dangers to which an insect egg is exposed from the moment it is laid include not only animal and plant enemies, but also frost, heat, moisture, dryness. When all the manifold hazards are considered we must marvel that these creatures are able to survive.

There are many things about the ways of insects that we do not understand. It has been customary in place of complete explanations to refer their remarkable habits to instinct. While this may be the only word that can be applied, it does not tell us how these habits originated. Few if any insects show any evidence of reasoning, yet there is undoubtedly reason behind the development of many of the things that they do, and man has never equalled them in some of their accomplishments.

As an example we might consider one of the ichneumon flies that is parasitic on the European corn borer, a pest that has become very common in the United States since its introduction a dozen years ago. The ichneumons are classed with the bees, ants and wasps but are very different in both habits and appearance. They are almost all long, slender insects, and the female is provided with an ovipositor that varies in length according to the habits of the adult in laying eggs. The ovipositor is composed of three rigid, hair-like appendages which are used for drilling and which form a tube through which the egg passes. The particular species that is parasitic on the corn borer is able to determine the location of the borer within the corn stalk, insert its ovipositor into the caterpillar and lay an egg. Man, up to now, has not devised a method by which the larva can be located. It is all the more remarkable in view of the fact that insects are not considered to be intelligent creatures. We know that these ichneumons do this but we do not know why, nor how the practice developed.

Eggs are hidden

Concealment is the most generally practised of all methods of protecting not only eggs, but also the young of animals. Almost all land animals conceal their young and primitive man was no exception. Just as the tiger, the deer, the birds and other creatures seek a hiding place in which to harbor the young until they are able to fend for themselves, so do insects hide their eggs. There is a difference, of course, because the larger land animals are able to protect their young while most of the insects cease to have interest in their offspring as soon as the eggs are laid. This does not apply to social insects, that actually feed the young and care for them, if not with tenderness at least with a devotion to duty that might well shame some of us intelligent moderns.

The method of concealing eggs may be of a most primitive nature, consisting merely of placing the eggs in some crevice in bark or under leaves, or it may be extremely complicated. Many insects lay their eggs within leaves or under the epidermis of the stems of leaves or green twigs. Most of the saw flies are equipped with a saw-like ovipositor with which they are able to cut the surface of a leaf and insert an egg beneath the epidermis. The young of these are leaf miners, living within the leaf until they are ready to pupate. Many other insects deposit their eggs in the twigs of plants and thus secure excellent protection for them.

Protection against other insects

The advantage in such a method is the defense against other insects that might parasitize the eggs; and thousands of different kinds of insects have developed it. The young of very many of the insects that lay eggs in twigs, upon hatching out, feed outside the wood.

Still more protection is secured when the eggs are deposited well beneath the bark, particularly if the young feed in such places. The horntail, an insect injurious to trees, lays its eggs in the solid wood, having an ovipositor that enables it to pierce the bark. The act of oviposition by this insect is not always without danger to the mother. It often happens that she is unable to withdraw the ovipositor with the result that she dies, her carcass hanging rigidly on the side of a tree to attract the attention of passers-by. Whether these dead horntails are martyrs to an overzealous desire to deposit their eggs deeply or not is a question that is open to some doubt. It is altogether possible that they have already laid many eggs and that death resulted from natural causes due to the wearing out of the organism.

The habit of protecting the egg by injuring the plant on which it is laid in order to prevent the growing plant from crushing the egg is not uncommon. A good many of the long-horn beetles that oviposit in wood make an incomplete circle or arc a short distance from the egg, thus preventing growth until the hatching period has passed.

The long-horn beetles known as twig girdlers lay their eggs inside the tender shoots of blackberry and other plants and girdle the twig both above and below the point of oviposition. The girdle is not complete, consisting of a series of round areas that the beetle chews out, but it is quite sufficient to cause the shoot to die above the lower "girdle." When the egg hatches the young larva bores downward into the pith of the living cane, while the dead tip usually breaks off and falls to the ground. In this instance there is a distinct lack of intelligence, because a single "girdle" beneath the egg would be quite sufficient to halt growth. There is a possibility that some of the eggs do not survive either because the lower girdle does not always do its work or the end of the twig breaks off before the egg hatches, leaving the larva no opportunity to bore downward to the healthy cane.

The plum curculio, an insect that feeds and lays eggs in a number of different fruits, but more particularly in apple, peach and plum, always leaves a telltale mark behind. After laying the egg a half circle is eaten out and as the fruit grows this takes on a lunate appearance. This protection is not always sufficient in the rapidly growing fruits and a very large percentage of the eggs die. Anyone familiar with the work of this beetle can always identify the injury and can determine between the feeding and ovipositional punctures.

Most nuts are attacked by some insect. Sometimes it is only the husk that is affected, but some of the weevils attack the kernel. In order to lay its egg on the prospective food supply the mother weevil eats a small hole through the husk and soft shell and inserts one or more eggs into the hole. Since her snout is long and quite slender she is able to bore with little difficulty and without causing more than passing injury to the growing nut. The wound soon heals and only a small spot remains to show that the nut is infested by her offspring.

Jumping beans

The so-called Mexican jumping beans are a familiar sight at places of amusement during the latter half of summer and autumn, always attracting a great deal of attention. They are not beans, but the seeds of certain species of plants belonging to the genus Croton, a relative of the castor oil plant. The "beans" themselves have no power of jumping, this being furnished by the caterpillar of a small moth which is closely related to the coddling moth which bores into apples. The egg of this moth is laid in the calyx of the young fruit, the young larva boring its way into the pod and attacking the seeds.

The act of jumping results from the activity of the caterpillar within the ripened capsule: it bends downward and takes its tail in its mouth. Then, suddenly straightening itself with considerable force, it causes the "bean" to jump. The larvae of the cheese skippers hop about in the same way, but as they are free living, there is no external covering to be moved by them. It is not positively known why the larvae in the seed capsules jump. It may be for exercise or to move the pod into a position that will prove more comfortable. Heat is often used to increase the activity of the "beans." When it is, the jumping is quite evidently for the purpose of escaping the unwelcome heat.

A first meal of tadpoles

In the preceding paragraphs we have given examples of insects that lay their eggs in or very close to the food that the young will eat. We have dealt with those feeding on plant life or parasitic upon other insects. There are some insects that are parsitic on vertebrates that also lay their eggs directly upon the larval food. Most of the large predacious diving beetles feed upon small fish and tadpoles of certain frogs, and the mother beetle provides for this by laying her eggs in the frothy egg masses of the frogs. When the eggs of both hatch the young larvae of the beetles at once begin to feed upon the tadpoles. As a result the insect larvae secure an excellent start in life and should be in fine condition to carry on their search for individual tadpoles when the egg mass of the frogs is finally depleted of its inhabitants.

The habit of laying eggs within the actual food which the young will eat may be looked upon as a direct protection, since it not only eliminates the necessity of searching for food, but at the same time offers concealment. Some insects are not so considerate of their offspring and the protection sometimes concerns only the species and not the eggs. An example of this is to be found in some Tachinid flies which scatter more than a thousand tiny black eggs over grassland where caterpillars are likely to come along and swallow them. Inasmuch as these flies are common it is evident that the method is effective even though it may seem to be wasteful.

As to why this habit should have developed we can only guess. Perhaps the adult flies were not sufficiently energetic to search out their prey as most of their relatives do. This, however, is scarcely a good explanation. In any event we may be thankful that this habit serves as an efficient method of retaining the balance of nature. In years when armyworms are abundant, many more of the tachinid eggs are eaten than in a year when caterpillars are less numerous, with the result that probably a uniform percentage of this serious pest is destroyed from year to year. The protection of the eggs in this case is to be found in their small size, as there is very little chance that they will be crushed during the feeding of the caterpillar.

Some of the tangle-veined flies do protect their eggs by laying them in cracks on fence posts or in crevices in the bark of trees, but they have little consideration for the food supply of their larvae because the insects upon which these feed are found in the ground. However, nature has taken care of this situation by providing newly hatched larvae with some long, curved hairs. When the larvae hatch they take a position with these hairs exposed and wait for a gust of wind to come along. When it does arrive they are torn from their seats and carried by the wind, eventually dropping to the ground. Their next task is to find the larva of a june beetle or some other subterranean insect upon which to feed.

Armored eggs

Many insects cover their eggs with a protective substance which may be composed entirely of a special secretion of the insect or it may have attached to it hairs and scales from the mother. One of the better known examples of this type of protection is found in the Chinese preying mantis, an insect introduced into America and now very common in the vicinity of New York. There is no doubt that the covering protects the eggs against some enemies but it also has its disadvantages because it serves to attract the attention of birds, squirrels and mice. These animals tear open the tough covering and devour the eggs, but they are not the only creatures that attack them for, despite the protection afforded, the larvae of some flies are able to enter the egg mass and develop to maturity. The fly larvae probably receive relatively greater protection than the eggs of the mantis because the apparently empty egg masses will not be disturbed by birds or rodents.

The lowly cockroach

In a group of animals as primitive as the insects we would scarely expect to find an even greater development of protective covering than demonstrated by the preceding type but it does occur, and, of all places, among the lowly cockroaches. The cockroaches are among the most primitive of living insects, their history dating back at least one hundred million years in geological history. The common and detested cockroach of our kitchen protects its eggs by furnishing a hard egg sac in which the eggs are arranged in rows. When this egg sac is ready to be laid it does not pass completely from the body, a portion remaining within the abdomen of the mother. It is carried by the insect for some days, but before the eggs are ready to hatch it is secreted in some suitable place, the mother taking no further interest in it. Some other cockroaches cover the eggs with only a very thin egg casing and do not carry the case at all.

As to the origin of this remarkable habit we can only speculate. It may have arisen as a result of the inability of the mother to find a suitable place in which to hide the eggs, with the result that succeeding generations carried them for longer and longer periods, or it may have arisen accidentally because of inability to completely discharge the large egg sac.

While we usually think of protection by an exterior covering as embracing only those insects that lay their eggs in masses we know that certain insects cover single eggs. It is also true that we usually consider the protective covering to be a secretion discharged from the abdomen at the time the eggs are laid and we know that practically all eggs are covered with a sticky substance at that time. This sticky substance, which dries very quickly, enables the egg to adhere to the surface upon which it is deposited and is, of course, essential to the welfare of the egg.

Among the psocids or bark lice the mother protects her eggs in an unusual manner. At least we may consider it unusual, because we know of no other insects that employ the same method. After the egg is deposited the psocid bites off tiny pieces of bark and chews them for a moment. She then ejects onto the egg a drop of saliva in which the masticated bark is contained. This quickly spreads over the egg and dries. The protection offered by this coating is probably twofold—it coats the egg with a substance much darker than the egg itself and at the same time adds a strengthening coating to the thin shell. The food of psocids consists of fungus growths so that the insect has gone outside of its foodstuffs in order to secure a suitable substance.

We are all well aware that bees, wasps and ants build nests in which to lay their eggs and that many of them provision the nests with honey and pollen. These insects not only provide a home and food for the eggs and larvae but many of them actually feed the young and care for them most carefully. However, many of these insects merely provide food, which usually consists of other insects and spiders. The common mud-daubers provision their nests with spiders and lay one egg in each cell. An egg is laid in each cell as soon as it has been stocked with food and the end is then closed to protect the offspring from possible enemies. The enemies of the mud-dauber nest would not have any particular interest in destroying the young larvae, but there are a number of flies that would otherwise welcome the opportunity of depositing living maggots on the spiders. These maggots, having the advantage of being able to feed at once, would devour the food of the mud-dauber larva and leave it to starve to death when it hatched.

A roundabout method

In contradistinction to those insects that protect their eggs by giving them an exterior covering we have others in which the egg shell is very thin in order to allow the larva to escape at the first favorable opportunity. In some of the bot flies this condition exists. The eggs may be laid on the legs of animals, but so long as they remain here they will not hatch.

They are licked off by the animal, hatching almost as soon as they enter the mouth, or at least by the time they reach the stomach. In some of these flies the eggs hatch as soon as they come in contact with the moisture of the animal's nostrils or lips.

Perhaps the most remarkable habit to be found in the insect world has developed in another bot fly that has become known as the "human bot," although it attacks a number of warm blooded animals. This fly actually makes use of other flies to carry its eggs to the host. The carriers most frequently used are mosquitoes but almost any biting fly may be utilized.

The adult bot fly captures a mosquito and deposits a number of eggs upon its under side, sometimes thirty or more, after which it releases the carrier. The mosquito, in search of blood, locates a warm blooded animal and proceeds to feed. As soon as the eggs come in contact with the warm surface of the animal they hatch and the maggots proceed to enter the host. However, they are unable to break the skin but must enter through some wound or a fold where they can exert pressure. The most common point of entry is naturally the puncture made by the mosquito. So this pest not only carries the parasites to their host but actually provides a means for their entrance into it. The same use is made of other biting flies, and in particular of the stable fly, although this latter is less easily captured than the delicate mosquito.

Insect waylayers

There has been published an account of how the adults of the human bot have lain in wait for mosquitoes emerging from pools in order to deposit eggs upon them. When a mosquito emerged it would be observed by the bot adult until it settled. The larger fly would then capture it and proceed to lay its eggs.

If the theory that has been put forward concerning the development of this strange habit is true these egg-layers must have developed their technique to a remarkable degree within a relatively short time. According to one theory the flies originally laid their eggs on the animals themselves, but were limited to those that lived in the forest, because the flies cannot stand the strong sunlight of the American tropics. As a result animals of the plains were not attacked. However, the flies developed the habit of laying eggs on the leaves of trees overhanging trails which the range animals had made. These leaves would take on some of the odor of the animals and serve as a guide in egg laying. In the same way the mosquitoes and other biting flies are supposed to retain some of the odor after feeding, with the result that the bot fly would be guided in laying its eggs on suitable carriers. It would be a natural step from this to the development of the habit of ovipositing on newly emerged mosquitoes.

These bots do an enormous amount of damage in South America to the hides of range cattle. It is estimated that the actual loss will amount to at least a billion dollars annually if the vast ranges of the continent are ever fully utilized for cattle grazing. At present the damage is placed at a mere ten millions.

A good provider

Some of the wasps show either intelligence or something that closely approaches it. There are many kinds that dig their burrows in the hard ground and provision the nests with caterpillars. After the female wasp has dug the tunnel she comes to the surface and proceeds to plug the hole with soil, packing and smoothing it so that the entrance cannot be distinguished. She then flies away in search of a caterpillar. When she returns with her prey she opens the entrance to the tunnel, drags the caterpillar in, lays an egg on it and once more covers the entrance, this time using greater care than before. Some species employ a small pebble with which to pack the soil placed over the entrance. The reason for this extreme care is obvious if one cares to watch the operation. Several small grayish flies may be observed in the vicinity of the tunnel. They are waiting for the wasp to return with the caterpillar. Their object is to deposit living maggots on the food. The wasp apparently knows this, because, while digging out the opening, she makes many hurried sorties toward the caterpillar in order to shoo the flies away. Once she has it inside she probably feels safe, but it is often while she is dragging it in that the flies drop the maggots onto it. The relationship between the wasp and flies is a most interesting one and while there have been many observations made it is not fully understood.

In order that eggs may endure the cold of winter they must be protected by a thick shell, one that can expand without breaking, or by some other means. The eggs of the plant lice, and those of some other insects that are laid singly on the twigs of trees, are small and quite hard. During an average winter they are capable of surviving with only a small mortality and in a warm winter almost all will hatch in the spring. But during a season such as we have just endured the mortality is very high because the contents of the eggs freeze to a greater extent than usual and the vital elements are destroyed. In other instances the eggs themselves become cracked.

The susceptibility to frost and low temperatures is a relative one. Eggs of the same species of aphid occurring in cold parts of Canada and in our South Atlantic States will show a remarkable difference in resistance. Those in the north will withstand temperatures of below zero while those in the south will succumb with only a few degrees of frost. It is not only the cold that enters into this destruction. It is well known that a period of warm and cold spells alternating is much more destructive to insect life than continued cold, because of the relatively sudden changes that take place in the egg. Many insect eggs must have exactly the right amount of moisture and any appreciable deviation from the normal results in death. Some are, of course, laid in water and others in dry sand but these are especially adapted to the particular environment. Some of those that are deposited in water are capable of surviving if they dry out. The eggs of certain mosquitoes are laid at the edges of fresh water pools that will dry up when summer comes, leaving the eggs high and dry as soon as the spring rains have stopped. Under normal conditions the pools will not again fill for almost a year after the eggs are laid. The only moisture the eggs receive must come from occasional rain and thawing snow.

Delayed hatching

In the spring following the laying of the eggs they once more come in contact with water and then hatch. However, it sometimes happens that there is a dry winter, or even two or three, and the thawing snow or spring rains do not raise the level of the water to the "egg belt." There is undoubtedly a certain amount of drying out of the eggs and some mortality under such conditions but the majority are nevertheless able to survive. They hatch when the pool once more reaches normal height. In seasons of abnormally heavy snowfall and deep frost it is safe to predict large broods of early spring mosquitoes because the flood conditions reach eggs that may have been laid several years previously.

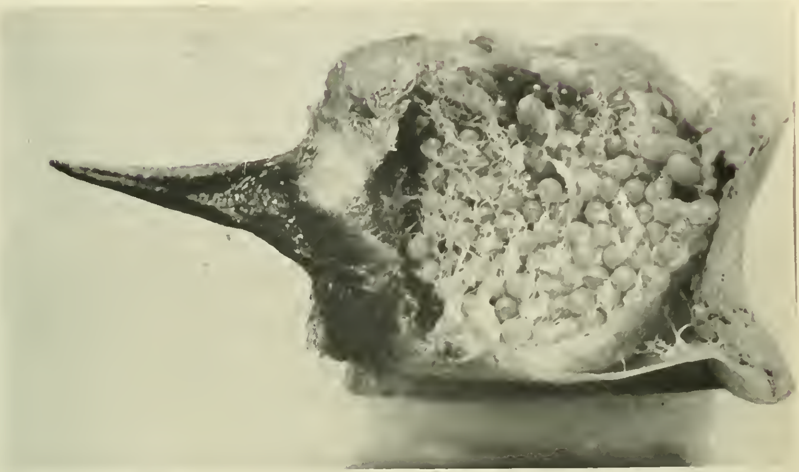
Although we are aware that the above described condition exists, we do not know the real solution of the mystery with which nature has surrounded these eggs. It would seem that there is some element connected with the eggs that allows them to hatch only under conditions found in the spring of the year, thus preventing the destruction of the species which would result from hatching in a short-lived summer pool.

Heat is, of course, deadly to insect eggs and even the most resistant can be killed by exposure for a few minutes to a temperature of 140 degrees F. Continued exposure to a temperature ten or twelve degrees above that to which they are adapted will destroy them, and the vast majority are killed by exposure to the summer sun. As a result most eggs are concealed in some way or are deposited on the under side of the leaf. Such protection is unnecessary during the winter months when the penetrating powers of the sun's rays are greatly reduced. Because of this fact we find the eggs of many insects that overwinter in this stage deposited on the twigs, trunks and branches of trees.

Numbers prove success

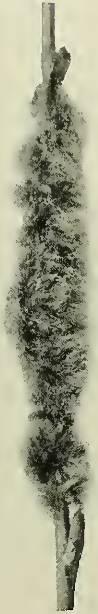
From the standpoint of survival a crucial period in the life history of any species is the period immediately following birth or the laying of eggs. It is then that the creature is usually most helpless. Without such intricately evolved habits as some of those we have discussed, the insects could not have survived to the number of more than a half million known species. There are approximately five times as many species of insects as there are of all other creatures put together. These figures alone prove, among other things, how effective are the amazing methods of insects for the care of offspring they will never see.

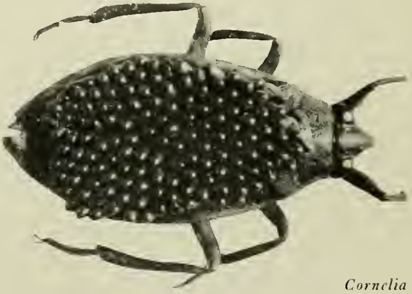
HOW INSECTS PROTECT THEIR EGGS



Cornelia Clarke

Insects, in order to survive, must lay their eggs where natural enemies will not destroy them and where the young larvae upon emerging will find proper food. The large, black water scavenger beetle (Hydrophilus) *lays its eggs as shown above in a silken case that floats on the water. The young larvae have gills and are adapted for life among aquatic plants*



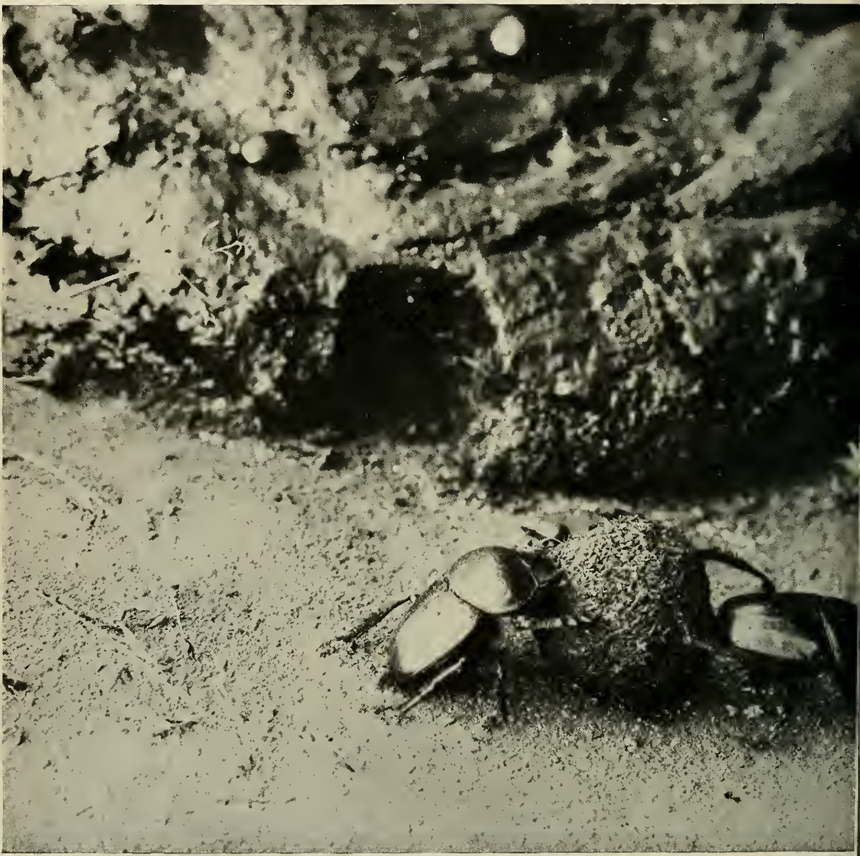


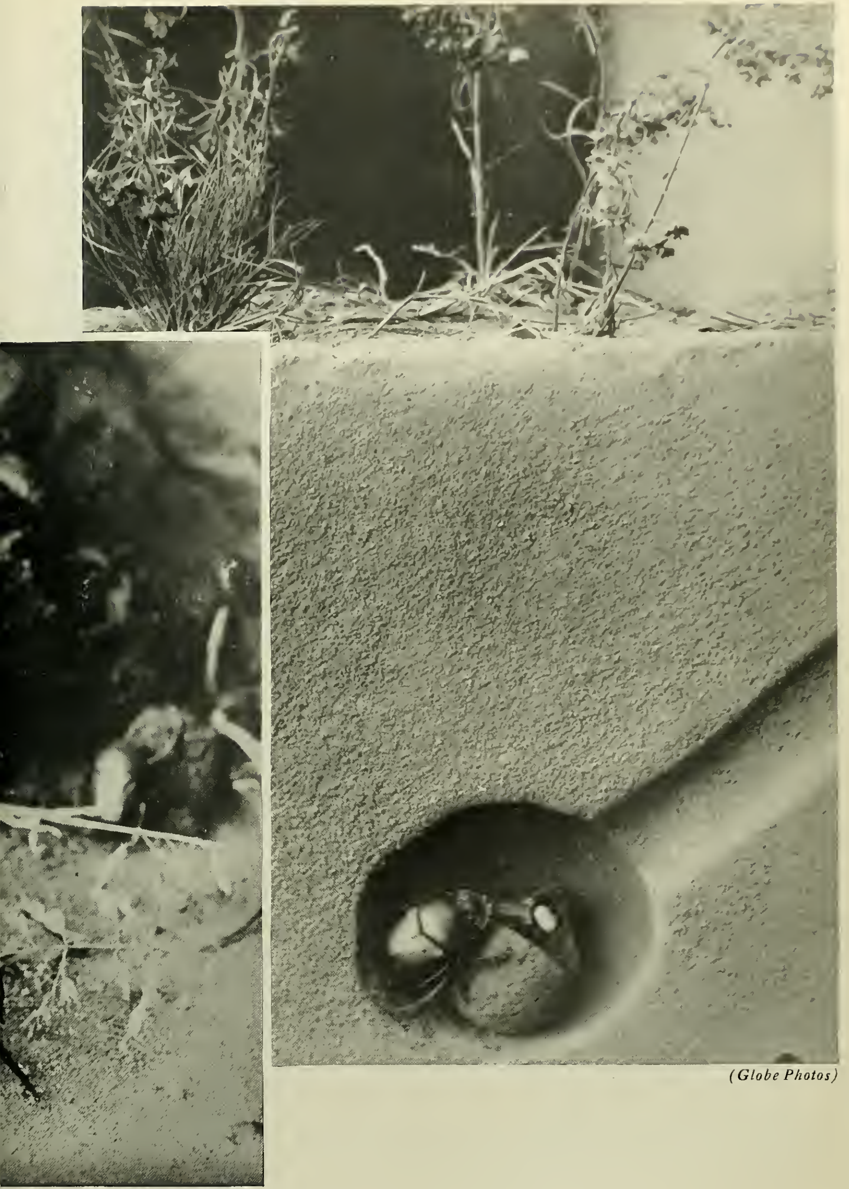
Cornelia Clarke

(Above) The mother water bug lays her eggs on the back of her mate. The wing covers are sealed under them and the male is unable to fly until the eggs are hatched

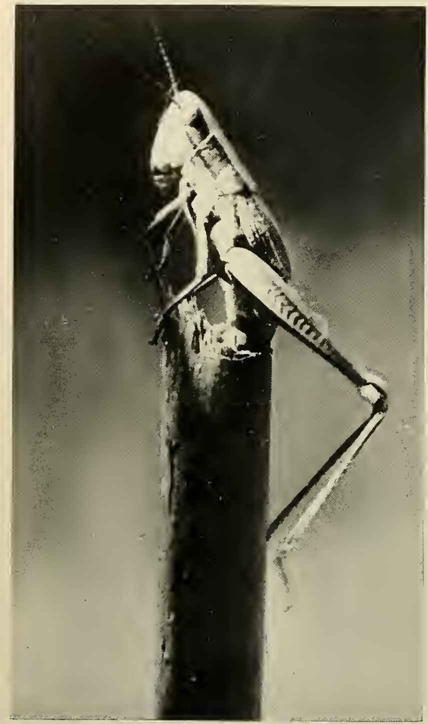
(Left) The European moth, Eriogaster lanestris, *covers its eggs with hairs from its own body. The hairs probably serve to protect the eggs against parasites* *(Globe Photo)*

(Below) An example of the beginning of cooperative effort among insects: a male and female beetle joining forces to provision the "nest." After locating fresh dung these relatives of the sacred Egyptian scarab dig a tunnel and excavate a broad chamber. The two beetles then prepare a ball of the material, which is to serve as food, and roll it into the mouth of the tunnel, the female going in ahead of it. (Right) Once in the chamber the female deposits an egg in the ball. In the sectional illustration shown here the ball is cut open to show the egg. Her mate waits at the surface to help her plug up the opening when she emerges. This prevents the food ball from drying out and insect enemies from entering



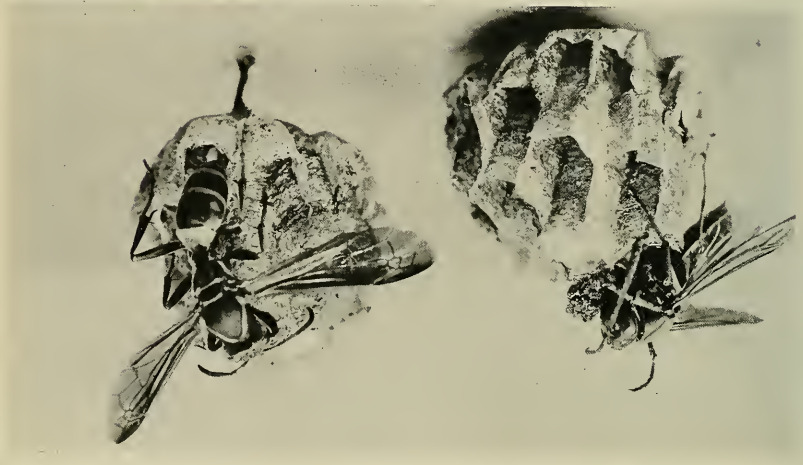


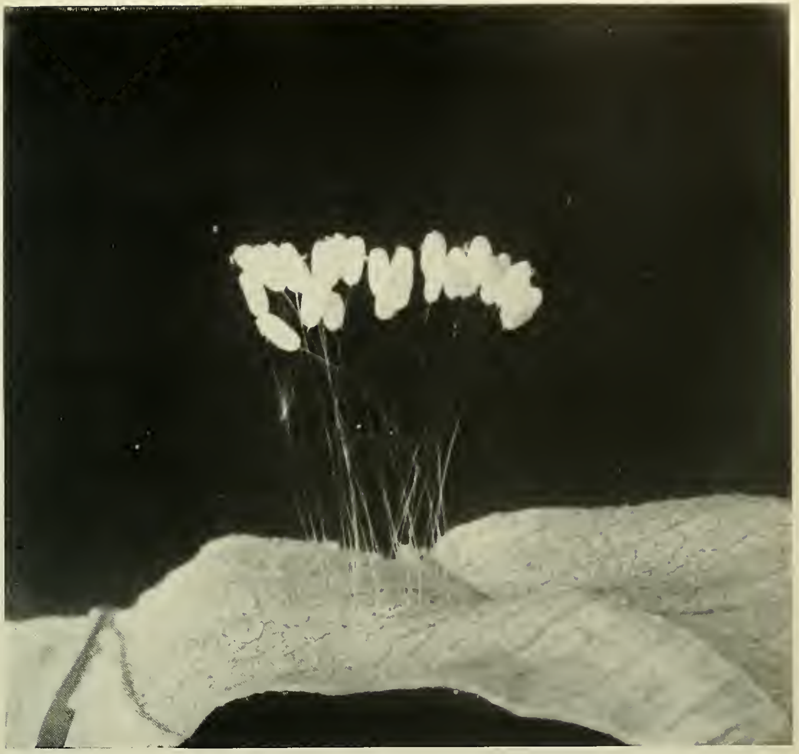
(Globe Photos)



The grasshopper shown at the left is engaged in the serious occupation of laying her eggs in the broken stem of a plant. She has forced almost the whole of her abdomen into the stem in order to deposit the eggs far inside, where they will be well protected *(Globe Photo)*

The paper making wasps of the genus Polistes *make small, open nests that hang downward from a slender stem. The cells each contain a single egg glued to the side near the bottom and are left open so that the adult can bring food for the young* *(Photo by Cornelia Clarke)*

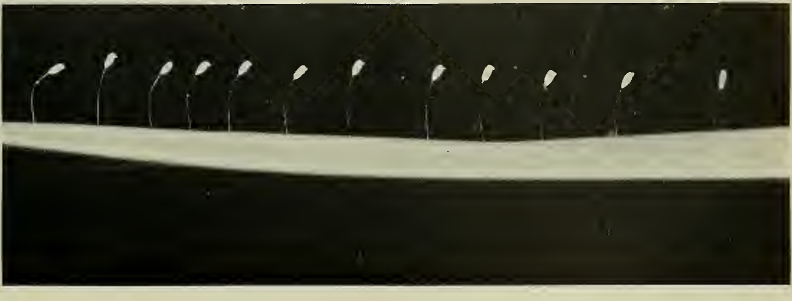


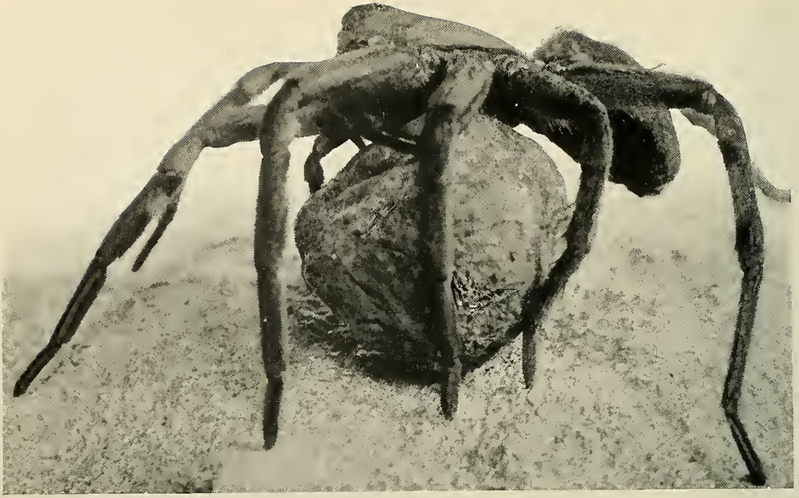


Globe Photo

(Above) The aphis lions lay their eggs at the end of hair-like stalks. If they did not do so the first hatching larvae would eat the eggs of their brothers and sisters. When planted in a cluster the bases of the hair-like stalks are set in a spiral formation so that the eggs above are kept apart. On narrow leaves, as shown below, the eggs are spaced in a single row

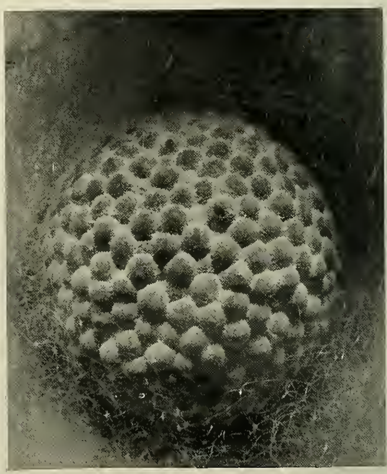
Photo by Cornelia Clarke

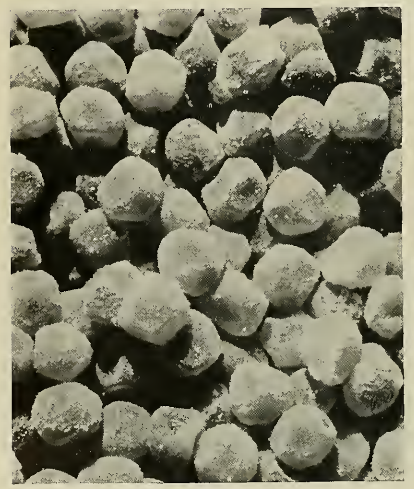




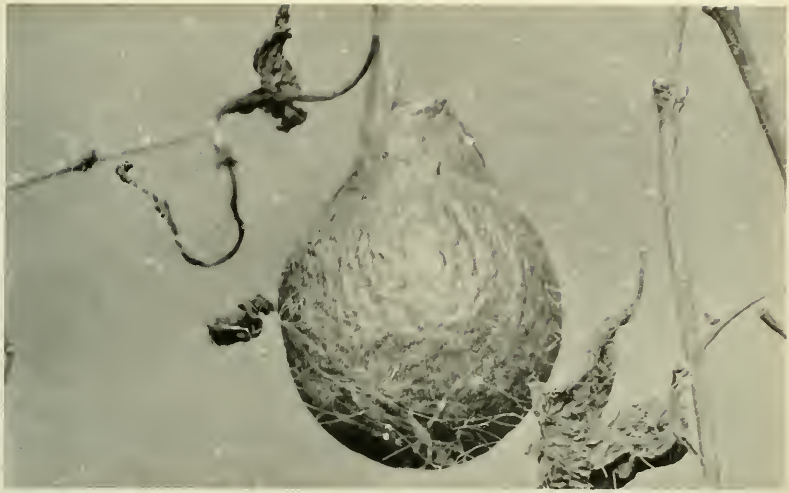
Photos by Cornelia Clarke

(Above) Spiders, although not true insects, also protect their eggs in interesting ways. The wolf spider shown above is carrying her silken egg case. It is a bulky load, but she is able to travel quickly with it, and will not discard it until the young hatch





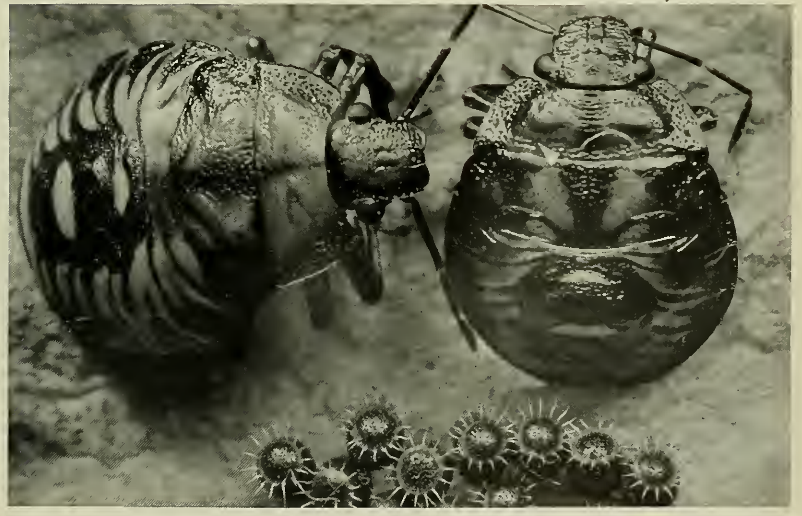
If the silken cover is removed from the eggs of the orb weaving spider they present the appearance shown above. At the left the same eggs are shown after being separated

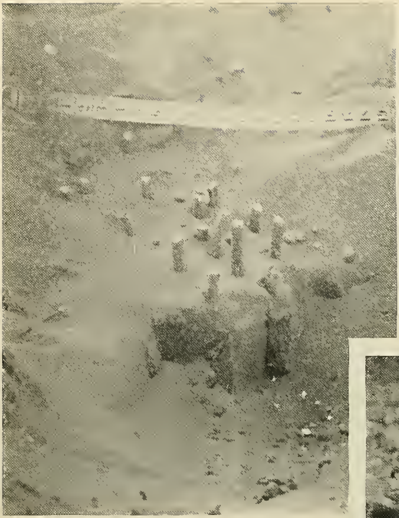


(Above) The garden spider hangs its light brown egg sac in a network of silken threads woven among weeds or long grass. The sac is closely woven and quite tough so that the eggs are well protected against the buffeting of winter weather

Below are two young "stink bugs" which hatched from eggs similar to the spiny ones shown near them. The eggs of these bugs have a very hard shell but there is a weak ring near the top allowing the whole cap to come off

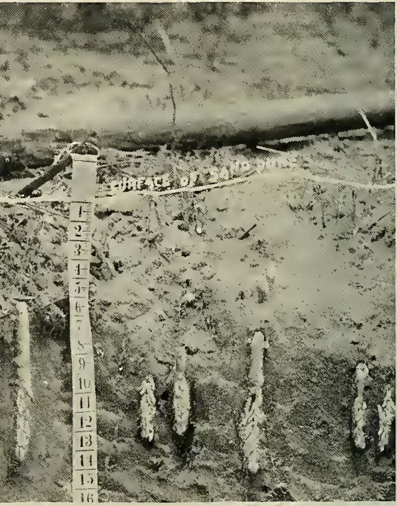
Photos by Cornelia Clarke



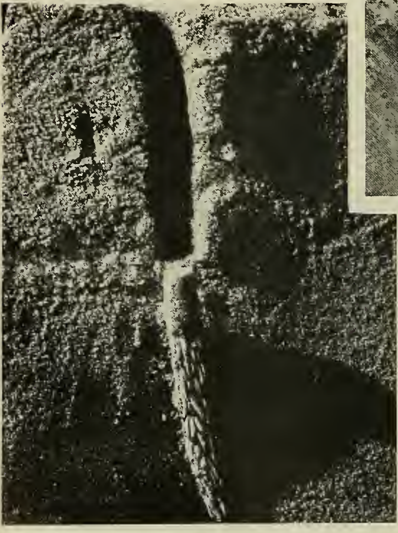


Sharp changes in temperature are a menace to certain insect eggs, especially in arid regions. In order to provide the eggs with even temperature and moisture, the Palestine grasshoppers bury their eggs deeply. At left shifting sands have exposed the egg-laying grounds of the grasshoppers. The projecting plugs are the material cemented by the female in the passages above the egg masses

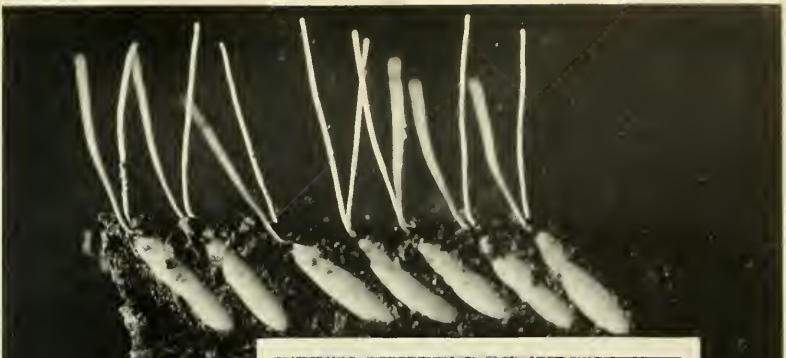
Below are shown the egg masses and the plugs above them in normal relation to the surface of the ground. The tape measure shows the almost unbelievable depth to which the female stretches her abdomen in laying the eggs



William Thompson Photos

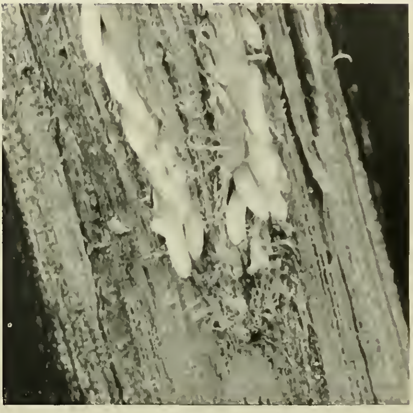


In the close-up of a single egg mass to the left the individual eggs may be seen, together with the sand plug above. The tunnel above was occupied by the female's abdomen during oviposition

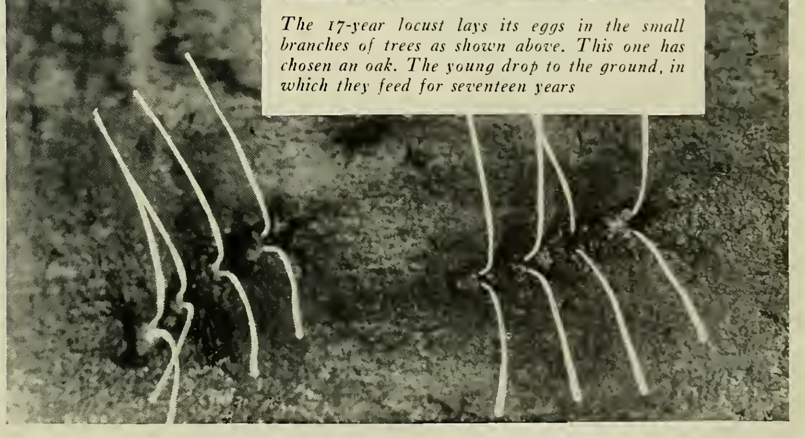


(Above) A piece of submerged wood on which an American water scorpion has laid its eggs. The two filaments that project from each egg into the water are the only indication of the presence of the eggs. At the bottom of the page these filaments are shown as seen from above

Photos by Cornelia Clarke



The 17-year locust lays its eggs in the small branches of trees as shown above. This one has chosen an oak. The young drop to the ground, in which they feed for seventeen years



The eggs of preying mantids are protected by a tough covering produced by the mother, shown at the right. Each kind of mantid has a different shaped egg mass

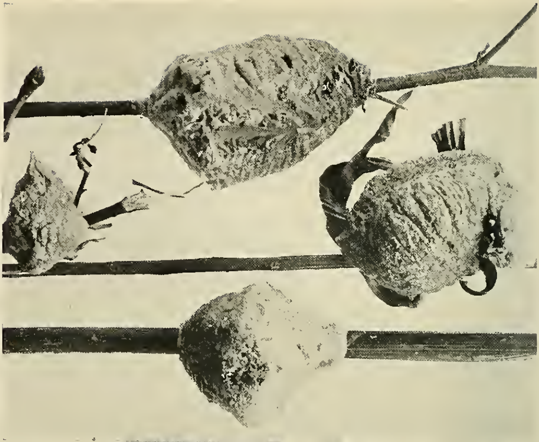
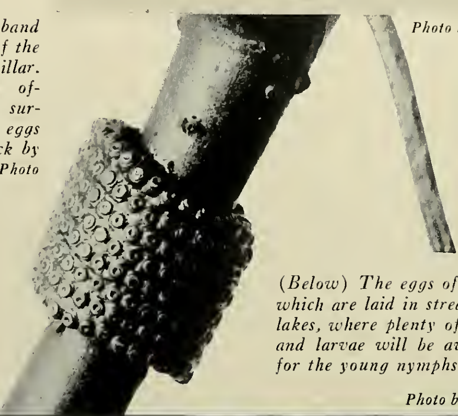


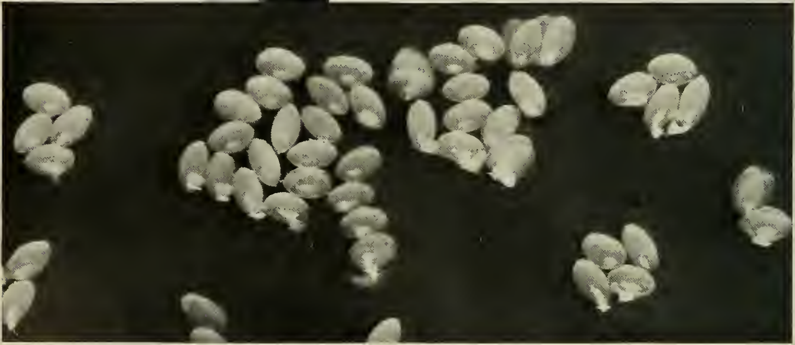
Photo by Cornelia Clarke

(Right) The spiral egg band of a European relative of the American tent caterpillar. Despite the protection offered by the substance surrounding the individual eggs they are subject to attack by small parasites *Clarke Photo*



(Below) The eggs of the dragon fly, which are laid in streams, ponds, and lakes, where plenty of aquatic insects and larvae will be available as food for the young nymphs

Photo by Cornelia Clarke



Big Money of Yap

In these tiny Pacific isles gigantic stone coins change hands in the market. A six-foot wheel buys villages and plantations

By WILLARD PRICE

PERHAPS the strangest and largest coins in the world are those to be found in isolated Yap, a small group of islands about eight hundred miles east of the Philippines.

It would doubtless cause surprise on Broadway if a man were to come down the street rolling a coin as tall as himself. But in Yap such coins are common. Some are indeed twice this size. Place one such on edge, and a tall man must stand on a tall man's head to reach the top.

In the center of each coin is a round hole. In an important coin, this is as large as a manhole. When the coin is to be paid, a tree is thrust through the hole and a crew of men partly lift and partly drag the coin over the ancient stone-paved jungle trails to the creditor.

In the port town, Japanese money is used—for Yap is under the control of Japan. But in the jungles of the main island and in the outlying islands of Map and Rumung Japanese money is rarely seen. The ancient stone money is still current.

Shopping with stones

While living in the thatch hut of a native king in a jungle village, studying native customs, I was amused to see how shopping was carried on by the use of stone money. The queen, when she wished to go to the trader's, did not sally forth with a pocketbook. She went down the shore path under the palms followed by a husky slave sweating under the weight of a three-foot stone disc supported on the shoulder by a bamboo pole thrust through the hole.

The village trader accepts such currency cheerfully. Of course he cannot exchange it for foreign goods. No bank in Tokyo, London, or New York would recognize his slab of rock as collateral. But he can pay it to some other native for coconuts.

A chief admired one of my hats.

"May I have it?" he asked. "I will pay for it."

"Please take it—as a gift," I urged.

He would have none of that. He paid, and paid handsomely. Four slaves groaned into our courtyard with a coin measuring four feet and weighing about two hundred pounds. My bewilderment as to what to do with it was soon relieved. The next day the chief took it back and returned the hat. His friends had made too much fun of him in this outlandish headgear. For hats, and most other articles of clothing, are strange to the natives of Yap.

Why such unwieldy coins?

How did Yap get such an unwieldy coinage? There is no record, since the Kanakas of Yap have no written history. But there is a native tradition according to which, some hundreds of years ago, one of the more disreputable gods thought to cause dissension among men. They were at peace because they had nothing to war over. He would give them something to war over. Money.

He whispered to a king of Tomil (one of the sections of the main island of Yap) a plan to make him great and powerful. Obedient to the heavenly vision, the king sailed south over unknown waters to islands of the Pelew group. There he found shining rock (calcite) which the malicious deity instructed him to have his men hew out with their shell-axes into flat pieces rounded like the orb of the full moon. These were loaded into the canoe and brought to Yap, not without many perils. The god cast a spell over the people that caused every man of them to desire nothing so much as one of these heaven-sent stones. To obtain them, they paid to the king of Tomil great riches in the form of coconuts, canoes, and houses. So the wheels became a medium of exchange for goods.

And those who tell the legend go on to say that there has been no peace in Yap since then. The golden (or stone) apple of discord disrupted the island paradise. Formerly there had been little covetousness; for there was little to covet. No man desired his neighbor's coconuts for he had his own. There was food enough for everyone and no one wanted clothing. Greed was born when money came in. Quarreling began among relatives as to who should inherit which rock. Feuds arose between neighbors, wars between villages. The elders of Yap, ignorant of the fact that the Bible designates the love of money as the root of all evil, have become convinced of this from bitter experience.

"Nine quarrels out of ten are over money," one told me. So we are given to suppose that the god had a great laugh at the expense of the people of Yap.

There was only enough of the first money to be tantalizing. Expeditions set out to get more. They went not only to Pelew but to Guam where an even finer stone could be obtained. But it is four hundred miles to Guam and the seas are stormy. Many canoes were lost, particularly on the return voyages when they were loaded to the danger point with great stone wheels. It was not uncommon for twenty canoes to set out for Guam and only one to return.

No counterfeiting

Of course the difficulty and danger in securing the stone kept up its value. There could be no counterfeiting, for there was no similar stone to be found in Yap. It is a calcite or crystallized carbonate of lime which forms in veins filling the cracks in limestone or other rock. There is nothing inherently precious about it. It has value to the Yap native only because it is hard to get and because it is the accepted medium of exchange.

If these goings-on amused the god, they also amused an Irishman named O'Keefe.

I found a cross-eyed old native sailor with the shamrock tattooed on his brown skin who had sailed with Captain O'Keefe for years. He told me the story.

Buccaneer O'Keefe cast anchor in Yap harbor during the Spanish rule (a rule that was largely characterized by the lack of any) and proceeded to look the natives over with a view to making what he could out of them. He soon found that they would give copra, fish, anything they possessed, for stone money.

Very well, stone money they should have. He had heard that large pieces were especially in demand. That was where he fitted in. On his schooner he could transport pieces many times as large as could be carried in canoes.

"He sailed to Pelew and went to the king," my informant related. "He asked for many men to help dig stone money.

"The king said, 'What will you give?'

"The Captain gave rope. He gave paint to paint the bodies of the dead. Dye to color lava-lavas (cloth garments wound around the waist). And some guns. He promised to give more when the work was done.

"The men of Pelew dug . . . many months, years. Small stones took little time. But it took two years to dig out a great wheel.

"We kept taking the wheels to Yap and selling them to the natives for copra.

Trouble in store

"But the chiefs of Pelew became angry because Captain O'Keefe paid no more and was cruel to the men. They looked for a chance to punish him."

The opportunity came when the Captain was wrecked in the Pelew group on the island of Babeldaob at Alklung. The natives seized all his goods. But this punishment was not enough.

They would give him some of his own medicine. They lashed him to a tree and brought out a cat-o'-nine-tails salvaged from his own ship. They flogged him.

After his release he lost no time in lodging complaint at Hongkong. A warship visited Pelew and demanded an indemnity in the form of large quantities of copra and bêche de mer (sea slugs) from the offending village of

Alklung. When the indemnity was not paid, two more warships came, landed their men and burned the village to the ground.

After a long series of ruthless, picturesque, and piratical exploits, Captain O'Keefe one day stocked his schooner at Yap for a long voyage, kissed his two wives good-bye, and sailed away. He never came back. Some say that he went to an island known only to him, for he was an excellent navigator and knew the South Seas as few men did. Others suppose that he was lost at sea.

A two-ton coin

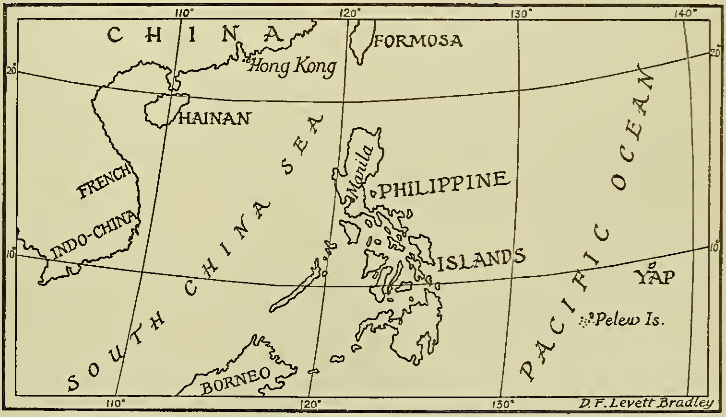
However that may be, he left behind him monuments that will stand to his memory for thousands of years. The largest coin of his minting that I saw measured twelve feet and its weight was estimated at about two tons. Flip that over the counter! But the greatest of all is said to lie at the bottom of Yap harbor. While being transferred from the schooner's deck to a raft, it slid into the water. The old men who saw it swear that it was twenty feet across . . . but that may be a "fish-that-was-lost" measurement.

Since this monolithic money is so cumbersome, barter is used for most small transactions. Goods are traded for goods. There are accepted values, recognized as standard. Two coconuts sell for one match. Ten nuts will buy one roll of bread. Ten nuts are the equivalent of one pack of Golden Bat cigarettes. The man who has brought his nuts from a great distance may demand and get one or two cigarettes extra. Ten leaves of tobacco buy twenty-five nuts. One cider-bottle of petroleum goes for twenty nuts and a beer-bottle of petroleum is paid for forty nuts.

The natives sell chickens, eggs, pigs, in the same way—for petroleum, phonographs, harmonicas; not for money. They do not understand money in the form of small silver and copper pieces, so insignificant compared with their majestic coins of stone. They cannot get the values through their heads. Too much mathematics is involved. Besides, who knows how long this foreign money will be good? First Spanish money came. Then German money, and the Spanish was no good. Then Japanese money, and the German was no good. But Yap money is always good. It goes on forever.

Other moneys

Stone is not the only form of Yap money. Shells of the pearl oyster are strung together and used as currency. Bags of copra are used. Also the remarkably fine lava-lavas produced by the artists of the neighboring island of



Yap, where stone coins are used, lies 800 miles east of the Philippines

Mokomok. A sack of these lava-lavas was kept as one of the chief treasures of the "All-Men-House" (council house) in our village. There was no thought of opening it and using the garments. It was kept intact to be paid sometime to another village for a canoe.

But barter and these lesser currencies are used for only small deals. For a great one, stone money comes into play.

The foreigner who regards these stones as of little value will be sharply disillusioned when he tries to buy one. He must pay goods to the value of about seventy-five dollars for a wheel from Guam a foot in diameter! The Pelew wheels cost less. A poor specimen, waist-high, is valued at four thousand coconuts, worth in the islands about twenty dollars. A stone as high as a man is worth many villages and plantations, and the stones two-men-high are considered to be beyond price.

Riches in the front yard

The great stones are not owned by individuals but by communities. They are displayed outside the All-Men-House which thereby acquires the native name, "Febai" (Money House).

Private homes are flanked with smaller pieces from two to five feet high. The Yap resident would consider it just as strange to take his money inside the house as we would to leave ours in the yard. "How," he would say, "can anyone see your money if you keep it in the house? Moreover, there would scarcely be room left for the family."

However, the small pieces, six inches or so in diameter, are kept indoors. Not only because they would be too easily carried away if left outside; but because the householder would be ashamed to show them. It would be like displaying pennies. He would be thought a poor man.

Therefore large stones are in demand. Rather than accept small wheels, the creditor prefers to let the bill mount until he can be paid with a handsome wheel great enough to attract real attention as it leans against his house or against the stone platform upon which his house is built.

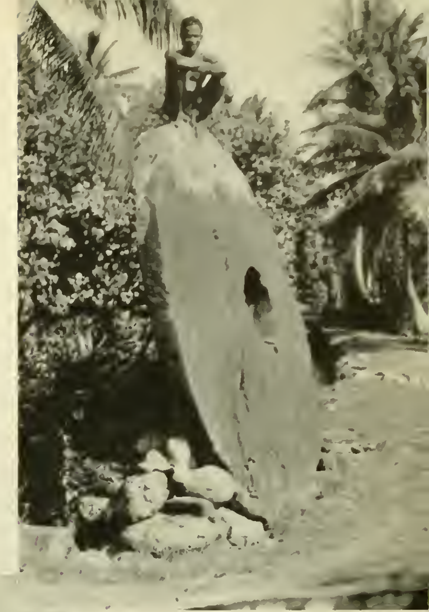
Such coins are rarely stolen. It is hard to slip away with a half ton of rock. Still it could be done while the people of the house are absent. But where could one take the booty? It would be futile to remove it to some island outside of the Yap group because such currency is not used elsewhere. If it were kept in the Yap islands it would be traced. There are no inscriptions on these coins by which to identify them; but the details, irregularities, and measurements of every wheel are memorized by the owner. He would recognize his wheel anywhere. The larger wheels even have individual names and are known by name and appearance to everyone in the islands. They are even better known than people; for people come and go, are born and die, but these familiar faces remain from generation to generation. Every wheel has its story, usually a story of blood, of fighting between villages for possession of the piece of rock, or of feuds between families, or of attempts to steal and hide the money, or of the killing of its owner by poison or a spear-thrust. Most of the tales of trouble and terror in Yap seem to cling like moss to these old stones. There are records of half the men, women, and children of the island being slaughtered in a money foray.

Inflation

Today the mint is idle. No more stone money is being "coined." This may be due partly to the growing competition of Japanese money. There is a greater reason. The population has shrunk to half its former size, while the supply of money has remained the same. So there is more than enough to go around. In other words, Yap's currency is inflated. Also, the value of labor has risen, so that it would cost more to go to Pelew and dig out new wheels than the wheels would be worth.

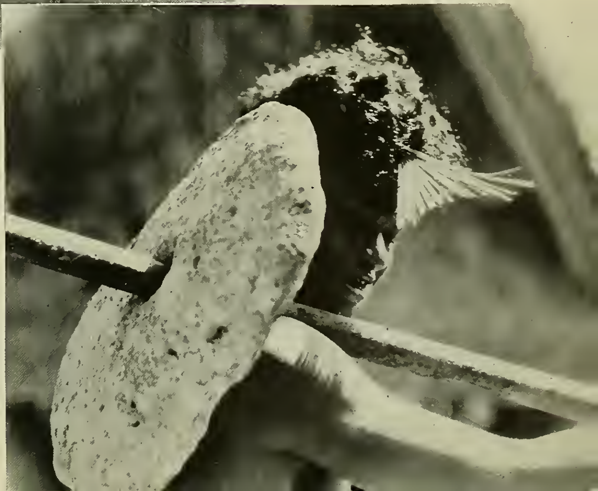
Although the use of the wheels as currency is slightly decreasing, the hoarding spirit will long keep up the value of the old stones. As each family dies out its stones are quarrelsomely claimed by others, still giving delight perhaps to the malicious god aloft. As house after house is abandoned, the wheels pile up around the homes of the survivors. As a result of wars, dissension, and disease, the race may die out. But the great stone wheels will remain, odd monuments to the evil of the love of money.

Big Money of Yap

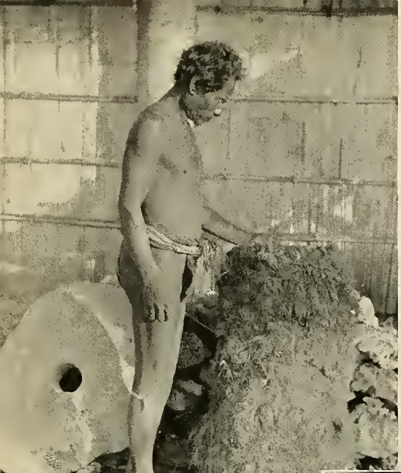


(Right) In this tiny group of Pacific isles, gigantic stone disks like the twelve-foot piece shown at the right serve as coins. One a foot in diameter is worth up to seventy-five dollars, and those two-men high are beyond price. The difficulty and danger in securing the stone from other islands is the basis for the value of these strange coins

(Left) A scene in Yap: an All-Men-House or Council House. Coins not owned privately but by the community are displayed outside this sort of building, which thereby acquires the native name "Febai," *meaning money house*

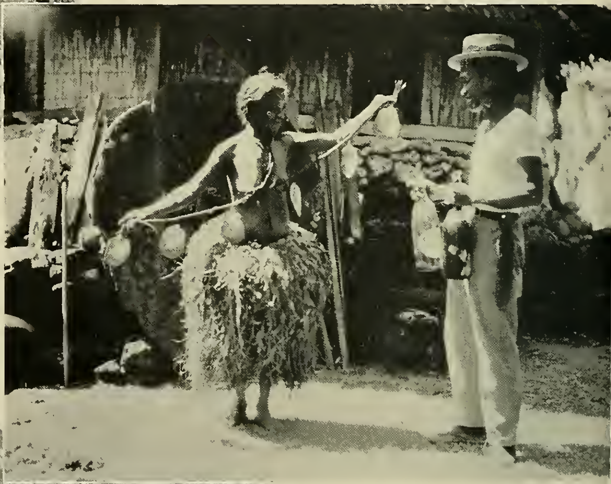


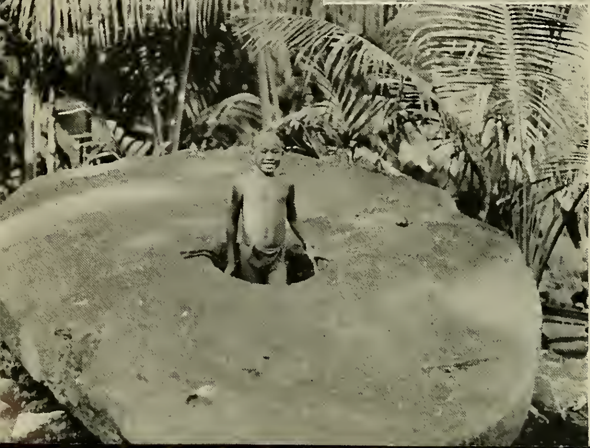
When a coin is to be paid, a pole or tree is thrust through the hole in the center and it is carried or dragged over the ancient stone-paved jungle trails to the creditor



It is the custom to display one's stone money in the front yard. The coins are rarely stolen because they can always be identified in the islands and the thief could not pass them in any other part of the world. The bundle in front of the man at the left also represents wealth. It contains valuable lava-lavas, *cloth garments that are wound around the waist*

(Right) A woman offering a string of shell money for a bottle of petroleum: a case where barter takes precedence over the cumbersome stone money, a piece of which lies idle in the background





An enormous coin said to be worth many villages. Today no stone money is being "coined." But the hoarding spirit will long keep up the value of the old stones

Science in the Field and in the Laboratory

Back from Panama—Museum Art Show—Glacier Bay—Reptile Hunt—Children's Fair

Entomologists Return from Panama

Curator Frank E. Lutz, Doctor W. J. Gertsch and Mr. Wm. C. Wood of the American Museum of Natural History spent February and March in very successful field work on the butterflies and moths of Panama. Two regions were selected in which to do intensive collecting. One was Barro Colorado, the large island in Gatun Lake, Canal Zone. It is almost entirely covered by a rather dense jungle typical of the low hills near sea-level in Central America and is the laboratory of the Institute for Research in Tropical America. The other was on the western slope of the Volcano (extinct) of Chiriqui near the Costa Rican border. Headquarters there were at an altitude of about 4200 ft. In addition to the high-altitude jungle, this region has a large area of naturally open country. It furnished a good contrast with Barro Colorado. The faunas of the two regions differ markedly, a condition which not only resulted in the expedition's getting a large range of species for the Museum's collection but also will, it is hoped, help in understanding the geographic distribution of insects in Central America.

Frederick H. Douglas

Mr. Frederick H. Douglas of the Denver Art Museum, Denver, Colorado, recently visited the department of anthropology. Mr. Douglas is distinguished for his knowledge of American Indian Art and for having built up in the Denver Museum one of the most important collections in the world. In connection with this work, he has developed the educational use of these materials to a degree not realized in other cities. His work attracted so much attention that it has been supported by the Carnegie Corporation and other foundations interested in the promotion of art and art education. Finally, Mr. Douglas has prepared and issued a series of about 100 leaflets dealing with the technology and art of various American Indian tribes. These are now recognized as classics and have been distributed to every country in the world.—C. W.

President Davison back from India

Mr. F. Trubee Davison, president of the Museum, and Mrs. Davison returned April 21 from a three-month trip to India. Next month NATURAL HISTORY is planning to run an illustrated article describing the interesting experiences Mr. Davison had on this trip.

The Arthur Lecture on the Evolution of the Human Brain

The fifth annual James Arthur Lecture on the Evolution of the Human Brain will be given at the American Museum of Natural History on the evening of May fifteenth. Dr. Samuel T. Orton, Professor of Neurology and Neuro-Pathology in Columbia University, will speak on "The Language Area of the Human Brain and Some of Its Disorders." Professor Orton illuminates his subject by the following brief explanation:

"The exclusively human faculty of language (speaking and understanding speech, reading and writing, and the use of meaningful gestures as in sign language) is controlled from a part of the human brain which is enormously expanded as compared with the similar area in the highest apes. It is also peculiar in that only one side of the brain is necessary for normal language functioning. A very small area of destruction by injury or disease will give extensive disorder of speech or reading if it strikes in the language zone and in the controlling or dominant side. A similar or even larger destruction in the non-dominant side will have no effect on language."

Experimental Biology

At a recent meeting of the American Association of Anatomists held at Duke University, Durham, North Carolina, several phases of the research work of the Department of Experimental Biology were presented.

Dr. G. K. Noble reported on his studies of the relation of brain structure to social behavior of vertebrates. A large part of the fore brain of vertebrate animals is formed by a mass of tissue called the corpus striatum. The function of this structure has not been fully understood. Doctor Noble showed that in both birds and fishes it serves as a mechanism for co-ordinating instinctive behavior patterns, especially those concerned with social life.

Dr. William Etkin took part in a symposium on the relation of hormones to growth and differentiation. The rôle of the pituitary and thyroid glands in relation to development has in recent years been a matter of extensive investigation. Doctor Etkin discussed the function of these glands in the development of Amphibia.

The American Museum's Annual Art Show

Many people show surprise when told of an annual Art Exhibition at a Museum devoted to Natural History. "Art belongs in an Art Museum" is their instant judgment, and herein lies an unconscious and therefore doubly sincere compliment to the men and women who serve science as artists. Science deals with facts and it is the work of Museum artists to record them. From the figures in black and white line that accompany the first brief reports on material new to science, to the more elaborate work in full color illustrating the final memoirs and monographs of completed research, the artist helps bring the wonders and beauties of our world closer to all. Again, in the exhibition halls, artists specialize in portraying nature so skillfully that one visitor, viewing a group for the first time, commented on the deadness of a wild dog, killed by a sambur deer. In reality, the deer and the attacking dog pack are all as dead as the "dead dog" lying at the base of a plaster rock, bathed in the sunlight of a painted background showing a spot in Asia thousands of miles away.

Thirty-seven contributors including regular staff artists, WPA artists, and other workers are represented by 258 exhibits in the American Museum's annual spring art show.

The paintings cover a wide range of interpretation. There are vigorous, colorful oils of animals and delicate, clean-cut marines that breathe of the briny deep. An old shack forms the inspiration for two paintings by the same artist, one in oil and the other in water color. There are sketches of badlands, the first attempt in oil to record for science the beauty of fossil-bearing formations; and watercolors of foreign scenes, unique for a certain mystic quality seldom encountered. Illustrations of material studied through a microscope and carried out in water color show an unusual use for this medium. Animal sketches in black and white, beautiful studies of insects, fish and shells show the many types of illustration done by museum artists.

The sculpture ranges from portrait heads, of intricate oriental design, to bold simple work in various media. Wood carvings include a young colt, portrait heads and decorative panels. Minature group models and decorative tiles, a sailing ship model, original designs carried out in gold and silver further emphasize the unusual versatility of the artists employed by the Museum.

—J. C. GERMANN.

The Glacier Bay Monument

The Glacier Bay National Monument in southeastern Alaska, established eleven years ago by President Coolidge, includes tidewater glaciers of the first rank in a setting of magnificent fiords and lofty peaks and a visible demonstration of what was happening all over northern North America at the close of the last Glacial Period—the slow retreat of the ice and the coming in of a new vegetation and a new animal population. Numerous well-preserved relics of interglacial forest make it possible to compare the life and development of the areas which animals and plants are again colonizing with these older associations.

Unfortunately, House Resolution 9275, introduced January 3, 1936, would open up this monument for mining purposes under the same conditions in which the public domain is open. As pointed out by the Ecological Society of America in a letter sent Dr. H. E. Anthony by the American Planning and Civic Association, the glaciers would be in little danger, but even a sparse mining population would result in the cutting of the young trees, the use of the interglacial forest relics as firewood, and the killing of the animal population.

The association requests that friends of conservation write protesting against passage of this bill, H. R. 9275, to Hon. Rene L. DeRouen, Chairman of the Committee on Public Lands of the House of Representatives, and to Hon. Robert F. Wagner, Chairman of the Committee on Public Lands and Surveys in the Senate.

Reptiles and Amphibians

Mr. C. F. Kauffeld, together with two friends of the department, recently returned from a reptile hunting expedition in the southeastern states, particularly Florida.

Although heavy rains which flooded the countryside hindered the work somewhat, they succeeded in securing fifty species, thirty-six of reptiles and fourteen of amphibians. Among the notable specimens were the rare yellow-lipped snake, *Rhadinea flavilata,* and the short-tailed snake, *Stilosoma extenuatum.* Only one large diamondback rattlesnake was found throughout the trip.

The Hayden Planetarium

A new Planetarium lecture on THE PLANETS will start Sunday, May 3, to continue during the entire month of May. This lecture will present in detail the various aspects of the planetary bodies of the solar system, illustrated not only by the Planetarium instrument itself, but also by the finest planetary photographs made through the world's great telescopes. In addition to the daily and annual motions of the sun and planets, the lecture will include explanations of such phenomena as direct and retrograde motion, inferior and superior planets, morning and evening stars, the Zodiac, and Bode's law. A general view will also be presented of the night sky in May.

Mr. J. V. McAdam, an enthusiastic Amateur

Astronomer, has lent two reflecting telescopes for exhibition in the Planetarium during May. Both of these instruments were made by Mr. McAdam himself. The larger one has a mirror of 12½ inches diameter which is coated with aluminum. Accessories used in the construction and operation of this telescope are also on exhibition. This is a particularly interesting group in view of the fact that some five thousand amateur astronomers in this country have built their own reflecting telescopes.

During this month there will be an exhibit in the Planetarium of astronomical paintings by Mr. James Perry Wilson. This collection includes paintings of solar and lunar eclipses and various views of the planet Venus in the evening and morning sky.

Amateur Astronomers Association

During May the following lectures and meetings will be held by the Amateur Astronomers Association in the large auditorium of the American Museum of Natural History. All those interested are invited most cordially to attend, as the meetings are open to the public free of charge.

May 6—Dr. Joseph Razek, University of Pennsylvania—"Color and Its Measurements."

May 20—Annual Meeting—Presentation of new by-laws. Election.

Short address by Dr. Clyde Fisher, President.

Junior Astronomy Club

A jubilee meeting on the ninth of May will bring the seventh season of the Junior Astronomy Club to a close. Beginning in the afternoon with a special lecture on "The History of Astronomy" by a club member, Lois Saphir, the meeting will close with outdoor observations in the park. A member of the staff of the World Calendar Association will address the club on "What Is Wrong with the Calendar?" Retiring president Robert Fleischer will be succeeded by his sister, Ruth Fleischer, the first girl to direct the activities of the club since its organization.

American Museum Lectures

The following free lectures and motion pictures are scheduled for the month of May:

MOTION PICTURES: Saturdays, at 2:00 o'clock; May 2, "Along the River Nile"; May 9, "Almost to the Pole"; May 16, "Frontier Woman"; May 23, "Medieval Moderns"; May 30, "Dixie."

SCHOOL CHILDREN: Fridays at 10:30 o'clock; May 1, "Birds of Spring"; May 8, "Sightseeing in China"; May 15, "Nanook of the North"; May 22, "Sequoia."

Two lectures for students in elementary biology and general science are to be given Tuesdays at 3:40 P. M. May 5, "Wild Birds and Their Human Appeal," Mr. Paul B. Mann; May 19, "Are You Going to Camp This Summer?" Miss Farida A. Wiley. The last lecture this season for students in general and advanced biology will be "Heredity and Environment as Factors in Life," given by Dr. George C. Wood, May 12, at 3:40 P. M.

Educational Broadcasts and Tours

The program for the American Museum Educational Broadcasts and Tours over WNYC during May is as follows:

May 7—The Story of Eclipses; May 14—The Pleasures of Astronomy; May 21—Canada—Our Northern Neighbor; May 28—China—Topsy Turvy Land.

The first two lectures will be given by Mr. Robert R. Coles and the ones on Canada and China by Mr. John R. Saunders. In June Mr. Saunders will lecture on Siberia, on Japan, and on the Philippines. The broadcasts are given on Thursdays at 5:30 P. M. and the tours of the Museum illustrating the lecture are planned for the Saturday following the broadcast at 3:00 P. M., but announcement about the tour will be made at each broadcast. The tours are free and all are invited.

Children's Science Fair

The eighth Children's Science Fair, sponsored by the American Museum of Natural History, under the auspices of the American Institute, will open in Education Hall May 17 and continue through May 24. Last year more than a thousand exhibits were made by students in the New York City schools, from the elementary grades through the senior high schools. Some 40,000 to 50,000 persons visit the Fair each year.

The exhibits are entered under ten classifications: Stars and the Solar System, Earth Studies, Plant and Animal Life, Biology, Physics, Chemistry, Conservation, Industries, History of Science, and Energy.

Exhibits in Branch Libraries

Many members who live at too great a distance to permit frequent visits to the Museum or whose programs of work or study conflict with Museum hours, may be pleased to learn about the interesting collections which are being shown under the auspices of the Museum's Department of Education in the branch public libraries in the boroughs of Queens, Brooklyn and Manhattan. Among these exhibits are collections illustrating the material culture of the native African tribes, North American Indians, Eskimo, Chinese, Mexicans; a collection of costume dolls; textiles; masks of the Javanese, Africans, Chinese, Tibetans and Japanese; astronomical exhibits; miniature habitat groups; a collection of beautifully colored butterflies; "Sea People and Their Castles"; and a collection of minerals used for gems and costume jewelry.

Bird Study Courses

Mrs. Gladys Gordon Fry, known to bird lovers and students as "The Bird Lady," opened her fifth series of bird and tree walks in Central Park in April, under the auspices of The American Museum of Natural History.

Central Park is one of the best places in the country to study migratory birds, and New Yorkers have a rare opportunity to observe many different species in a restricted area.

Art Exhibit by New York City Schools

An exhibition of the art work of the elementary and junior high schools of Greater New York was held in Education Hall of the American Museum from March 29 to April 19 under the supervision of Miss Edith L. Nichols, assistant director of fine arts in the New York City schools. The major part of the exhibit displayed creative painting and pictorial projects relating to the geography of New York City.

An Appointment

Mr. Paul B. Mann, associate in education at the American Museum since 1928, has been appointed chairman of the Standing Committee on Science and of the Science Council of the City of New York, the highest scientific position in the City's educational system. These two bodies have been established to assist in meeting the problems of science teaching in the secondary schools and to consider the broad aspects of science instruction.

Peter C. Kaisen

By the death of Peter C. Kaisen on March 18, at the age of sixty-six, paleontology has lost one of its outstanding technicians. In 1897 Mr. Kaisen, a Dane by birth, was a section foreman on the Union Pacific Railway at Aurora, Wyoming, where he came in contact with the American Museum expedition then inaugurating dinosaur work along the famous Como Bluff. Next year he joined the Museum party working in that region and remained with the Museum until his death.

For several seasons Mr. Kaisen engaged in the exploration, under the direction of Dr. Barnum Brown, of that richest of all dinosaur fields, the Red Deer River Valley of Alberta. Later he made expeditions to Alaska and Mongolia and recently worked in the Lower Cretaceous fields of Montana and Wyoming. Through his energy and skill, both in the field and in the laboratory, and his loyalty to the Museum, Mr. Kaisen placed the Department of Vertebrate Paleontology very much in his debt.

RECENTLY ELECTED MEMBERS

A report from the membership department lists the following persons who have been elected members of the American Museum;[1]

Patron

Mr. Beverley R. Robinson.

Fellow

Mr. William W. Conrad.

Life Members

Miss Rose Dougan.

Messrs. Towsend Lawrence, Daniel C. Pease.

Annual Members

Mesdames Samuel Shipley Blood, Charles M. Clark, Margharita Derfelden, George R. Fearing, George H. Hazen, Dora R. Isenberg, Walter Nowill, Henry Parish, Charlotte A. H. Smith, William G. Thayer, Jr.

Misses Sue E. Garis, Clara S. Pulsifer, Adele Frances Siegel.

Doctors Mary H. Layman, D. W. Palmer, Geo. A. Wyeth.

Professor Henry E. Crampton.

Messrs. Harold L. Alling, William R. Cady, H. D. Chapin, Sidney A. Hassel, Alfred B. Holt, George Huling, M. A. Monroe, T. Albert Potter, Frederick H. Rike, Frank C. Rude, Bernhard K. Schaefer, Percival C. Smith, A. C. Stamm, Harry H. Warlield, F. L. Yarrington.

Associate Members

Mesdames Gardner Abbott, Richard S. Austin, Leland V. Baker, John Barker, Edward Warren Beach, C. H. Bentley, Anna Voorhies Bishop, Francis E. Bishop, J. H. Blizard, Charles R. Blyth, Gretchen Burleson, Frank Coleman, Charles A. Day, Margaret Power Drum, E. P. Eastman, Mary L. Farraher, Harry H. Fetter, Mary G. Ford, W. W. Gaar, Frederic Gooding, E. M. Green, Henry Theodore Hagstrom, Fannie Harmon, Addie W. Harrison, M. G. Haughton, John H. Hollis, W. L. Hunton, Edward S. Jamison, Luman W. Johnson, Arthur W. Johnstone, Myra W. Kennett, Ada Latham, Geo. L. Lingner, Ruth White Lowry, T. D. Mabry, Daisy Macdonald, Jas. N. MacLean, T. B. Masterson, Leslie M. Mattingly, F. W. McAllister, Frank B. Moses, Harry Loomis Munger, Mary S. Parsons, Charles L. Paulson, Jr., Elizabeth R. Powers, Babette Ramsey, F. E. Richter, Loring G. Robbins, A. M. Schaefer, Sherwood Winslow Smith, William Szitnick, N. A. Thompson, Linnie Tickell, L. F. Timmerman, E. B. Tyler, Camille T. Wagner, J. McLean Walker, Jefferson Brooks Walters, J. F. Wenk, Russell White, Lois E. P. Willis, B. A. Young.

Misses Rosabel Allin, Virginia Armstrong, Dorothy Bartol, Marie Gignoux Bates, Katharine Beverley Bayton, Bertha Forbes Bennett, Ida E. Bliss, Elizabeth Bogart, Mary G. Brown, Laura Buterbaugh, H. Virginia Cahill, Ina Conner Campbell.

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[1] New members not listed in this issue due to lack of space will be listed next month.

The New Books

Children of the Mutineers—Life of the Seas—Jennings' "Genetics"—Books on the Stars

THE HERITAGE OF THE BOUNTY. *By Harry L. Shapiro. Simon and Schuster, New York. $3.00.*

ARCTIC ADVENTURE. *By Peter Freuchen. Farrar and Rinehart, New York. $3.50.*

WE EUROPEANS. *By Julian S. Huxley and A. C. Haddon, with a Contribution by A. M. Carr-Saunders. Harper and Brothers, New York. $2.50.*

DISEASE AND DESTINY. *By Ralph H. Major, M. D. D. Appleton-Century Co., New York. $3.50.*

As THE "Zaca" neared Pitcairn, Doctor Shapiro was terrified lest this "shadow of an island" might fail to equal the image he had treasured for twelve years. He had long been preparing himself for the opportunity to study at first hand this unique blending of English and Polynesian blood and culture. Back in 1923 he almost got to Pitcairn, but found himself obliged to choose a five-months' stay on Norfolk Island instead. There he was able to study the numerous descendants of the Bounty mutineers now living in Norfolk.

Doctor Shapiro's successful trip to Pitcairn was made with the Templeton Crocker 1934-35 Expedition, which was described by Dr. James P. Chapin in NATURAL HISTORY for November, 1935, and April, 1936. *The Heritage of the Bounty* includes a short history of the Pitcairn Islanders from the first settlement by nine fugitive mutineers, with the Tahitian women they had taken as wives, and the six native men they carried along as servants. Doctor Shapiro makes the astounding story of how a psalm singing and humbly industrious population arose from a heritage of lust and murder as clear as the conflicting early documents permit. He is favorably impressed by the biological results of this unpremeditated experiment in hybridization, isolation, and inbreeding. The islanders seem in no way degenerate and the only noteworthy defect of any kind shown by any large number of these people was the almost universal loss of teeth, which "had produced a curious sucking-in of the cheeks and a collapse of the mouth." Several of them reminded Doctor Shapiro of the bird man in Barnum and Bailey's, with their thin prominent noses and atrophied jaws. Fortunately, a dentist has recently settled temporarily among them.

The islanders who eargerly boarded the "Zaca" looked more like English dock workers than the Polynesians of romance. But after living and working with them Doctor Shapiro came to feel friendship and something of admiration for these most interesting hybrids.

Pitcairn, a rocky-shored island, some two miles long, had no inhabitants when the mutineers and their followers landed there in 1790. In 1808 after a series of murders and battles among the few inhabitants (including revolts by the women) there were left "one surviving mutineer, eight or nine Tahitian women, and twenty-five children. These last were the progeny of the Englishmen and their Tahitian wives, the native men having left no offspring." As Doctor Shapiro points out, the islanders were already showing the orderly characteristics for which they later became famous, "Morning and evening family prayers were made a regular practice and services were held on the Sabbath."

Morality and a prodigious increase in the population apparently were correlated in the subsequent history of Pitcairn. As Doctor Shapiro says, "Vital statistics are the bookkeeping of a nation. They reveal the present state of affairs, uncover past trends, and cast up a balance, favorable or otherwise." From 1808 to 1856, the inhabitants increased from thirty-five souls to 193, or over 550 per cent. In 1856, fearing that the resources of their small island would no longer support them, the colony moved *en masse* to Norfolk Island. By 1864 about forty-five of the emigrants had returned to Pitcairn and it is from the voyagers who returned that the present population of over 200 is derived.

The Heritage of the Bounty is an excellent account of the history and present status of the people of Pitcairn, presenting its scientific conclusions in a thoroughly digested and entertaining form. Doctor Shapiro's style is clear and direct and admirably conveys the flavor of this microcosm of Anglo-Polynesia.

The Great Dane of Greenland

Peter Freuchen's contribution to anthropology is not based on the friendly objectivity of the scientist; he gained his knowledge of Eskimos by living with them, by eating their stinking food, by enduring their hardships (once cutting off his own toes with a nail puller and a hammer when his foot was gangrened), and by marrying an Eskimo woman and raising two children. His life with her was an exceedingly happy one and it was not until her death and the crippling of his feet that he began to feel that Greenland was becoming impossible for him.

Since coming to this country Freuchen has written two popular books and has savored the delights of Hollywood; it would be interesting to know if he has conditioned himself to his present environment as happily as he did to such an utterly different one during his fifteen years in Greenland and northern Canada. He went to Greenland first in 1907, because he feared boredom in his native Denmark; he really wanted to work hard, to fight the elements for a bare living in a country where both much labor and good fortune are necessary to secure seal meat and skins. But he was fortunate in his companions. From his, as well as from other contemporary accounts of the Eskimos, the stay-at-home reader gathers the impression that if one *were* obliged to live in Greenland the Eskimos would certainly be the best companions to live with.

Freuchen relates a good many incidents that could hardly be retold in a family magazine, of which the Eskimos' custom of lending their wives to friendly visitors, is perhaps the least disconcerting. But his book leaves a final impression of being the adventure of a fine and understanding soul among a people admirable for their humor and their kindness.

We Europeans

The approach taken by Messrs. Huxley and Haddon in *We Europeans* is indicated by the subtitle, *A Survey of "Racial" Problems,* in which they put the word which is the focus of so much and such bitter argument in quotation marks. They are convinced that:

> "No single scheme of classification can satisfactorily pigeon-hole all known human types, or even deduce without error the number and characteristics of the original 'primary' races of man. Whereas in the evolution of animals, there is a constant branching, each branch being isolated after a certain degree of differentiation by becoming incapable of fertile crossing with other branches, in man the branches constantly meet and unite and produce new types of shoots."

Hence, Huxley and Haddon think that the terms "race" and "sub-species" as applied to existing human groups have no significance. On the Nordic question, they admit that separate types can be distinguished within the white "ethnic group" (to use the phrase they favor), such as the tall fair Nordic, the round-headed Eurasiatic (often called Alpine) and the short, darker, long-headed Mediterranean. But they believe that there is no concrete evidence to show that "these hypothetical stocks once existed in a state of complete or almost complete purity." They think that six or seven thousand years ago blond and dark hair, tall and short stature, brachycephaly and dolichocephaly, were already widely distributed among the tribes of Europe. However, they admit that the present distribution of the Nordic type in Europe can be ascribed with reasonable certainty to invasion by a group composed largely of "men of this type—perhaps in the degree in which the type is now found in parts of Scandinavia."

But while Huxley and Haddon admit the existence of the type they are extremely sceptical as to its exclusive possession of qualities that fit it to rule over other types.

Following Hrdlička, Huxley and Haddon think that the Nordic element in the "Old Americans" is small. They point out that observers get very different impressions of a people at different periods: where foreigners were once struck by the prevalence of tall lantern-jawed individuals in the United States they are now impressed by "the prevalence of square-faced stocky business men." As to national character:

> "There was a time when England was called 'merry'; during the nineteenth century that epithet was not applicable. In Elizabethan times the English were among the most musical of the European nations: the reverse is generally held to have been true in late Victorian times . . . In Carlyle's time, the German national character was supposed to be peaceable, philosophic, musical and individualist. After the Franco-Prussian war it became arrogant and militarist. Now we are witnessing the blossoming of tendencies to state-worship, mass-enthusiasm and the like."

Perhaps the most interesting chapter of this book is the one on "The Principles of Heredity as Applied to Man" which contains an incisive discussion of Mendelism and the gene-mechanism of heredity and such new light as they cast on human problems.

Did Nietzsche Cause the War?

Disease and Destiny traces the influence malaria, smallpox, the Black Death (bubonic plague according to Doctor Major), and other diseases have had on the human race and its great men. The subject is a fascinating one; Doctor Major has collected many entertaining facts, and he reminds us effectively that malaria probably had a good deal to do with the decline of Greco-Roman civilization and that the plague in Athens may have damaged that city as much as the Peloponnesian War.

Unfortunately, Doctor Major is still toying twenty-two years after 1914 with such questions as "Did a paretic [Nietzsche] cause the World War?" He thinks that, through Nietzsche, "the French disease [syphilis] has changed the course of human thought just as it may have played a leading rôle in precipitating the recent catastrophe." Such weird opinions as this make one doubt the validity of his other conclusions.

—Gordon Lawrence.

A Natural History of the Seas. *By E. G. Boulenger. D. Appleton-Century Co., New York.*

Popular interest in all matters pertaining to the life of the seas has been so universally aroused in recent years that there has been a great demand for books on the subject adapted to the general reading public. This new book by Dr. Boulenger is eminently adapted to fill a definite need in this connection. It is a concise review of the animal life in the seas, moving rapidly from the simplest forms of animals through the great invertebrate phyla and concluding with chapters on the fishes, sea reptiles and mammals. Finally, there is even a chapter on the legends regarding sea monsters.

Many striking forms of life are dealt with in the book, and curious partnerships between widely different species are described, such as, for example, the hermit crabs that carry stinging sea anemones on their backs for protection while they themselves furnish transportation and tear food apart to share it with their partners; giant jellyfish which shelter young horse mackerel; and Portuguese men-o'-war which protect certain fish from their enemies. Crabs, shrimps, sea stars and sea urchins are dealt with in turn, while many diverse strange and beautiful species of sea worms add to the picturesqueness of the fauna described.

In a chapter on mollusks, the author reviews, in brief but interesting manner, the most striking of the sea snails, not only along our own coasts but those found in other seas, from the common periwinkle of the Atlantic coast and the polished cowries of eastern seas with their beautifully patterned shells, to the violet snails which build rafts of air bubbles and swim on the ocean surface. The voracious whelks are described that bore holes in other mollusks to suck out their soft contents. The bivalve mollusks are briefly described, from common oyster to giant clam, and several pages are devoted to description of squids and octopuses.

Descriptions of a remarkable diversity of fishes are packed within a few pages and pictured most vividly, from the familiar food fishes to the odd and grotesque creatures of the deep seas. In another chapter, sea turtles, marine lizards and the poisonous sea snake are mentioned, while manatees, seals, walruses and whales are not neglected.

The book contains somewhat over two hundred pages of text, and is filled with striking figures and photographs. As a whole, it forms a useful and popularly worded introduction to the life of the seas.— Roy W. Miner.

GENETICS. *By H. S. Jennings. W. W. Norton & Co. 372 pages. $4.00.*

No field of modern biology has advanced more rapidly than that of genetics. Numerous journals devoted entirely to this field of research have sprung up in many parts of the world. America has from the very beginning taken the lead in this study. Although numerous text-books in English and foreign languages have appeared from time to time, few of the popular accounts which have appeared have been at all comprehensive.

Prof. H. S. Jennings, Director of the Zoological Laboratory of Johns Hopkins University, has been a leader in the field of experimental biology throughout the period that genetics has made its most important strides. In reviewing this field he has brought to bear a considerable amount of critical judgment, while at the same time he has avoided mere technical terms, with a view to making his book attractive to the intelligent layman.

The recent work on the effect of high temperatures, X-rays, radium, and various other physical agents on the hereditary mechanism are fully described. This includes the recent studies of Jollos, Muller, Goldschmidt, Plough, Demerec, Horlacher, Johnston and others. The work of Stockard on the relation of endocrines to genetics in the evolution of the dog tribe with its possible bearing on human evolution is also discussed. There is a chapter on the constitution of the chromosomes and genes. The latter are no longer theoretical units of heredity. Several workers have claimed to have seen genes. Professor Jennings fully discusses this phase of the problem. There are other chapters which give the reader a clear view of the laws of inheritance and the action of genes during development. The recent discoveries as to the nature of sex both from the genetic and from the endocrine aspect are described, including the latest views on the relation of the autosomes to the sex chromosomes. The rôle of the environment in evolutionary change is also fully considered from the various aspects. *Genetics* is a book which all students of nature will find both comprehensive and inspiring.— G. K. N.

CONSIDER THE HEAVENS. *By Forest Ray Moulton. Doubleday, Doran & Co., Garden City. $3.50.*

Doctor Moulton is one of the world's leading authorities in astronomy, and especially in the field of celestial mechanics; he is co-author (with Chamberlin) of the Planetesimal hypothesis of the origin of the solar system. His new book is not just another book on astronomy; but it is definitely one of the outstanding recent works on the subject.

The book is intended to give a good picture of the stars and universe, and an idea of the methods of scientific thought, by which the astronomer arrives at his data. It is very pleasing to read, but not too easy by any means; to grasp the full significance without a careful reading would be difficult. Yet this book is very highly recommended by the reviewer because of its authority, the amount of data, the incomparable way in which the story is told, and the point of view of the author.

The first chapters give some history and a good idea of order prevailing in the seeming complexity of celestial motion. The Sun and all his family of planets are described in an absorbing way and there is a long chapter on their origin. Life on other worlds has a good chapter. Moulton says:

"If we could go to Mars! . . . vague visions . . . of rocket cars capable of making journeys through interplanetary space . . . there is not in sight any source of energy . . . to get us beyond the gravitative control of the earth . . . there is no theory that would guide us through interplanetary space to another world . . . no means of carrying the large amount of oxygen, water, and food . . . no known way of easing our ether ship down. . . ."

The last half takes up stars, nebulæ, stellar systems, and galaxies. Taking an illustration from geology the author compares the study of paleontology to that of the stellar systems:

". . . Hutton and Lyell . . . read in the records of the rocks geological history extending back over millions of years . . . the dynamical records written in the regularities of the globular clusters are expressed in characters which are fully as intelligible and as certain as the records in the rocks, and they cover periods perhaps a million times as long as the entire history of our earth."—HUGH S. RICE.

WORLDS WITHOUT END. *By H. Spencer Jones. The Macmillan Company, New York.*

THIS is a popular astronomy book—an introduction to the study of Astronomy—by that learned and distinguished man of science, H. Spencer Jones, the Astronomer Royal of Great Britain. That this book is scientifically accurate goes without saying—and this alone would make it a valuable addition to modern popular astronomical literature. That it should be such an eminently readable book as it is, a book which communicates so easily and so conversationally, the high spots of astronomical knowledge, is a matter for even greater rejoicing. There is here no text-book atmosphere, no condescending of the teacher to the taught. One sits down comfortably in the study of this wise astronomer and listens to his simply delivered words. And the picture of the universe here presented is a clear, an understandable one, insofar as it is understandable to any man. The earth, the solar system, the stars, the galaxies,—a review of past history and future possibilities,—all are presented here with no dogmatism, with no prejudices, but with the sanest judgment and a profound understanding of the limitations of our knowledge. The chapter called "Life in Other Worlds," for instance, could serve as a model of this kind of writing, presenting the facts clearly, so far as we know them, and leaving the reader himself to wander about as he pleases among the possibilities. The reader who can look beyond the surface simplicity of this book recognizes the vast amount of erudition and experience which have gone into the presentation of this material. Dr. Spencer Jones seems to be not only a great scientist but an unusual teacher.

The illustrations are excellent, culled from here and there among the world's great observatories. —MARIAN LOCKWOOD.

THE MUSHROOM HANDBOOK. *By Louis C. C. Krieger. The Macmillan Co., New York. $3.50.*

AN ILLUSTRATED MANUAL OF PACIFIC COAST TREES. *By Howard E. McMinn and Evelyn Maino. University of California Press. $3.50.*

HERE are two excellent manuals, both beautifully illustrated, and of convenient size for carrying in the field.

The Mushroom Handbook is impressively complete. It contains thirty-two color plates, from paintings by the author and more than a hundred black and white drawings and photographs. Mr. Krieger tells which varieties are safe to eat and which are poisonous, giving the amateur about as sure a guide as he is ever likely to find (although some of us amateurs would decline to eat any mushroom we had gathered in the field, even after comparing it with all the handbooks). His account of the history and general characteristics of mushrooms is clear and concise; he tells in an interesting manner where they grow (and how to grow the cultivated species), their economic importance, seasonal occurrence, and the distinguishing characteristics of various species. He includes an appetizing array of recipes for cooking mushrooms.

An Illustrated Manual of Pacific Coast Trees is a thorough guide to the woody plants of one of the most interesting floras in the world. The dominance of the conifers, the pines, spruces, redwoods and their relatives in one of the richest forest regions is the more impressive, considering that similarly favorable locations in most parts of the world tend to be occupied by broad-leaved trees. Professor McMinn lists 59 species and varieties of native conifers against eighty-four ordinary broad-leaved trees, two arborescent yuccas and one palm. In our part of the world, in the whole vast area from Newfoundland to the southern boundary of Virginia and from the Atlantic west to the 102nd meridian, Britton and Brown list only twenty-eight native conifers.—G. L.

Recent Museum Publications

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No. 822. The Cricetid Rodents Described by Leidy and Cope from the Tertiary of North America. By Albert Elmer Wood.

No. 823. Results of the Archbold Expeditions. No. 8. Four Apparently New Polyprotodont Marsupials from New Guinea. By G. H. H. Tate and Richard Archbold.

No. 824. Structure of a Primitive Notoungulate Cranium. By George Gaylord Simpson.

No. 825. A Specimen of the Upper Cretaceous Multituberculate *Meniscoëssus*. By George Gaylord Simpson.

No. 826. Skeletal Remains and Restoration of Eocene Entelonychia from Patagonia. By George Gaylord Simpson.

No. 827. The Madagascar Hammerkop Described as New. By A. L. Rand.

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No. 830. Psammolittoral Rotifers of Lenape and Union Lakes, New Jersey. By Frank J. Myers.

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No. 833. A New *Diopsis* from India, with Notes on Others (Diptera). By C. H. Curran.

No. 834. Three New Species of *Meromacrus* (Diptera, Syrphidae). By C. H. Curran.

No. 835. On *Decapterus Scombrinus* (Valenciennes). By J. T. Nichols.

No. 836. New African Diptera. By C. H. Curran.

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VOLUME XXXVIII ★ ★ ★ ★ JUNE 1936

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From a drawing by George F. Mason

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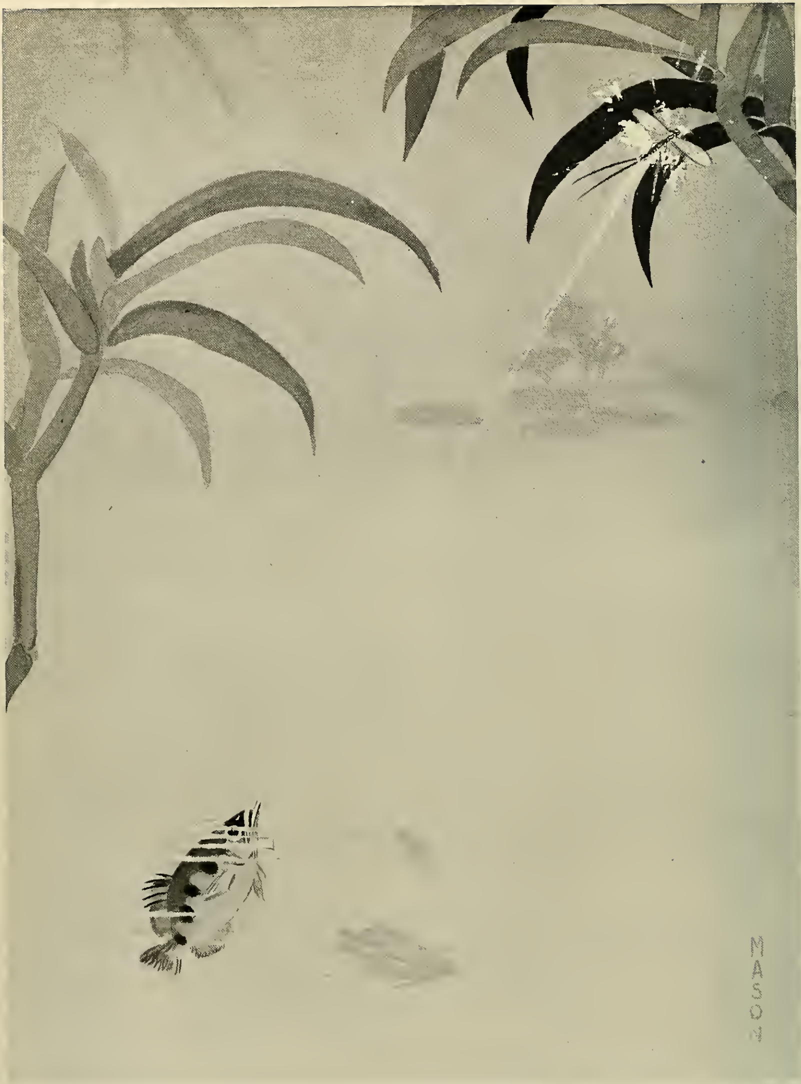

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The Archer Fish

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By HUGH M. SMITH
Formerly Fisheries Advisor to the Kingdom of Siam.

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The earliest record

The first definite printed reference to the fish in a European language seems to have been published in the year 1765, in the *Philosophical Transactions of the Royal Society of London.* At a meeting of the society held on March 15, 1764, a communication* was read from John Albert Schlosser, M.D., F.R.S., of Amsterdam, announcing the presentation to the society of a specimen of the fish which, to quote him, "I believe hath never been observed by any writer on natural history." The communication carried a description of the peculiar habits of the fish on the authority of a Mr. Hommel, governor of a hospital in Batavia, who was also the collector of the specimen. Designated as "the jaculator or shooting fish, a name alluding to its nature," the creature was described as follows:

> It frequents the shores and sides of the sea and rivers, in search of food. When it spies a fly sitting on the plants, that grow in shallow water, it swims on to the distance of four, five or six feet, and then, with surprising dexterity, it ejects out of its tubular mouth a single drop of water, which never fails striking the fly into the sea, where it soon becomes its prey. The relation of this uncommon action of this cunning fish raised the governor's curiosity; though it came well attested, yet he was determined, if possible, to be convinced of the truth, by ocular demonstration. For that purpose, he ordered a large, wide tun to be filled with sea-water; then had some of these caught, and put into it, which was changed every other day. In a while, they seemed reconciled to their confinement; then he determined to try the experiment. A slender stick, with a fly pinned on at its end, was placed in such a direction, on the side of the vessel, as the fish could strike it. It was with inexpressible delight, that he daily saw these fish exercising their skill in shooting at the fly with amazing dexterity, and never missed the mark.†

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*"An Account of a Fish from Batavia, called Jaculator." *Philosophical Transactions*, Vol. LV, for the year 1764, p. 89-91, plate 9.

†Unfortunately for the accuracy of the record, the fish to which Hommel referred and the specimen which he sent to London were entirely different species. Appended to the article was a copy of a description given in 1754 by Linnaeus of a species called *Chaetodon rostratum* (known in later years as *Chelmo rostratus*), and the accompanying plate was of that fish of the coral reefs. There were thus precipitated the misunderstanding and doubt concerning this fish which lasted for nearly a century and a half.

IMPORTANT NOTICE TO MEMBERS

Natural History is not published during July and August. Therefore it will not be necessary for members to send in a change of address notice if they are to reside at a summer residence during these two months.

A second article on this fish,[*] also contributed by Doctor Schlosser, contained a description of the fish in Mr. Hommel's own words and gave additional information on the fish's peculiar habits.

Shooting powers denied

During practically the whole of the nineteenth century there seem to have been no new observations on the shooting powers attributed to the archer fish and no confirmation of the statements made by Hommel in 1765 and 1767. On the contrary, the leading authorities on oriental fishes denied that the fish did or could perform as claimed.

Dr. Pieter Bleeker, "the most active ichthyologist that ever lived," who spent more than thirty-five years studying the fishes of the orient, was author of more than four hundred articles on those fishes, and was long a resident of the same city (Batavia) as Hommel, was unable to verify the early accounts of the jaculator fish and in 1875 expressed the belief that it did not deserve the celebrity which had been imposed on it and that its reputation was based on an error of observation.

Dr. Francis Day, who devoted more than a quarter of a century to the investigation of the fishes of India and Burma and published monumental works thereon, withheld from Toxotes any credit whatever for its extraordinary shooting ability and erroneously ascribed to the coral-reef fish Chelmo the same ability. Thus, in "The Fauna of British India —Fishes" (1889), Day disposed of Toxotes in these words:

> It is stated in some works that these wide-mouthed fishes shoot insects with a drop of water in Batavia. Bleeker observed that he never witnessed this, and the action is one which the mouths of these fishes appear incapable of effecting.

In an earlier article,[†] "On Asiatic Blowpipe Fishes," Day argued that Hommel's account could not have applied to Toxotes and could only have referred to Chelmo. He claimed that "no one, that I can ascertain, has asserted that *Toxotes jaculator,* with its deeply cleft mouth, was able to use it as a blowpipe," and said further that "personally I paid special attention to this question when investigating the fishes of Burma, but no fisherman had ever heard of this ingenuity being attributed to Toxotes, and which I cannot help thinking, with the late Doctor Bleeker, must be an error."

The original source of misunderstanding, as disclosed by the articles in the *Philosophical Transactions* and the perpetuation of the error by Bleeker, Day, and others, was undoubtedly due in some measure to the fact that among the Malays both Toxotes and Chelmo are called by the same name, *sumpit-sumpit* (from *sumpitan,* a blowpipe).

One more quotation from a reputable source may be given to illustrate the attitude of mind toward the most characteristic habit attributed to the archer fish; this is from a notice of Toxotes by the late Professor J. S. Kingsley appearing in the *Standard Natural History* (Vol. 3, 1885):

> One of the species has been generally credited with the faculty of shooting drops of water at insects on low-hanging branches and thus securing them for food. There does not appear to be any adaptation in the organization of the mouth for such a feat, and skepticism must be exercised in the acceptance of the statement made. Certainly no recent confirmation of the old story has been given, and the tradition has probably resulted from some misunderstanding.

The fish comes into its own

Although several minor notices of the habits of Toxotes appeared in European periodicals in the last two or three years of the nineteenth century, it was not until the twentieth century had dawned that this fish may be said to have finally come into its own. The observations of a Russian ichthyologist, Zolotnisky, on the fish in captivity definitely corroborated the essential facts of behavior as set forth in the earliest published accounts.[‡] A number of living specimens had been obtained in Singapore, and these were subjected to close scrutiny and experimentation, with the result that not only were the long-disputed habits fully established, but new items of behavior were noted and set forth.

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[*] "Some further Intelligence relating to the Jaculator Fish." *Transactions of the Philosophical Society*, Vol. LVI, for the year 1766, p. 186-188, plate 8, fig. 6. Doctor Schlosser this time presented another specimen, and a description of it under the name *Sciaena jaculatrix* was given by the German zoölogist Pallas. A poor but easily recognizable illustration accompanied the article. The allocation of the species with the sciaenid fishes, or drums, was unfortunate, as there is not even a remote relationship; and in 1817 Cuvier corrected the error and established the genus Toxotes for the reception of the fish which has since been known as *Toxotes jaculator*. This form and five closely related species constitute the family Toxotidae, peculiar to the oriental region.

[†] *Zoölogist*, 1881, p. 91.

[‡] Zolotnisky's detailed report, "Le Poisson Archer (*Toxotes jaculator*) en Aquarium" was issued in 1902 in *Archives de Zoologie Experimentale et Generale.* Vol. X, p. lxxiv—lxxxiv.

Among the facts regarding Toxotes which were recorded by Zolotnisky and have been confirmed by the present writer and other persons in Asia and America were the following:

(1) The fish subsists largely on insects which hover over the water or rest on overhanging vegetation. When a fish approaches within a certain distance of an insect, it becomes stationary, points its head and turns its eyes directly at the prey, brings the front of its mouth to the surface of the water, partly opens the mouth, and forthwith propels a drop, or several drops, of water at the insect, which ordinarily is 12 to 20 inches distant, but may be 40 inches or more. The aim is true and the insect falls into the water and is at once devoured.

(2) The fish frequently swims backward. This habit is often observed when the fish reconnoiters a prospective prey, and backs from it in order to secure a good position for observation and attack.

(3) The eyes sparkle with seeming intelligence and their mobility is noteworthy. They can be directed laterally, upward, and backward, but may not be turned downward.

(4) Aerial vision is acute. Even small insects may be seen at a great distance and fall a prey to the fish's amazingly accurate aim.

(5) Discrimination and selection are apparently exercised in the choice of food; considerable ingenuity is sometimes employed in obtaining food; and in shooting at insects the distance and the force are gauged.

Doubt

Zolotnisky's paper was made the basis for a critical review of "The Archer Fish and Its Feats" by the erudite Dr. Theodore Gill, published by the Smithsonian Institution in 1909*; and the foregoing statement of Zolotnisky's observations is largely a paraphrase of Gill's rendering. Gill found it difficult to accept some of Zolotnisky's statements and in concluding his paper said:

> This summary is a true version of the article by Zolotnisky and will doubtless excite skepticism among physiologists at large as well as psychologists. It contravenes certain assumptions respecting the power and range of vision among fishes, as well as of the intelligence and reasoning powers of such lowly animals. The extent of expression assigned to eyes destitute of mobile surroundings and accommodative adjustments may also be deemed to be exaggerated. Distinction therefore must be exercised between the facts observed (or alleged to have been observed) and the inferences respecting such facts. It must be conceded, however, that fishes which manifest such peculiar action as the archers should be subjects for still more elaborate observations and experiments.

In recent years in America many people have become acquainted with the archer fish and its performances through examples in aquaria in New York, Philadelphia, and other cities; and a motion picture of a fish in action has been made at the New York Aquarium. The present generation of fish students everywhere may be pardoned for expressing surprise at the protracted skepticism, and wonder at the failure of doubting oriental ichthyologists to conduct practical tests.

How Toxotes shoots

One searches the literature in vain for an explanation or suggestion as to how an archer fish is able to propel a drop of water with such force and accuracy that it can dislodge insects on overhanging vegetation or hit them on the wing.

The doubt shown by zoölogists of the last century in regard to the reputed shooting powers of the fish was partly due to their failure to detect in the fish's mouth any special mechanism by which drops of water could be formed and expelled.

It is, of course, obvious that there must be some peculiar adaptation or apparatus in Toxotes to account for its extraordinary accomplishment. Let this be the occasion to point out, for the first time, the special anatomical and physiological features on which the shooting performance depends.

By carefully watching the fish at close range on many occasions in Siam, I formed an opinion of the probable propelling mechanism, and I subsequently verified that opinion by holding the fish in a basin or bucket of water in the position regularly assumed when shooting and making them perform almost at will. This was accomplished by the quick, forceful compression of the gill covers with my fingers. I was able to cause a fairly satisfactory imitation of the normal shooting act, and had no difficulty in propelling drops of water for distances up to three feet.

This compression of the gill covers would in itself not be adequate to account for the

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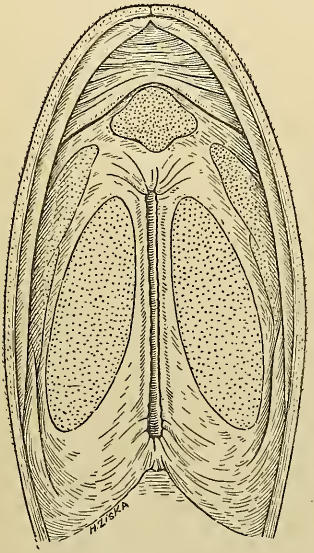
**Smithsonian Miscellaneous Collections*, vol. 52, part 3, p. 277-286.

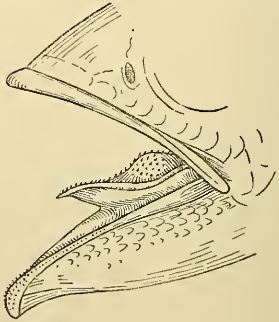
escape from the mouth of water in the form of individual drops of uniform size; and it is to the peculiar shape and structure of the mouth parts that we must look for the additional factors necessary for the complete and perfect performance.

The mouth cavity of Toxotes is long but its diameter is much restricted by the projecting sides of the roof and by the large tongue which when raised may completely close the passage from the outer air to the pharynx. The anterior part of the tongue is free from the floor of the mouth, and its rounded tip is of paper-like thinness and fits snugly against the palate; posteriorly the tongue is thick, bears minute teeth, and has a conspicuous fleshy prominence. Extending along the median line of the roof of the mouth, from a point just behind a band of vomerine teeth to the pharynx, are two low ridges, close together and parallel for most of their length, but slightly diverging at their posterior ends. Between the ridges is a deep groove which, when the tongue is applied to the roof of the mouth, becomes converted into a tube. This groove-tube, which in a fish seven inches long is less than a sixteenth of an inch in diameter, has not been previously described or referred to in ichthyological writings, but is readily seen when the tongue is depressed. That it should have been so long overlooked is something of a mystery when one recalls the vain efforts made by oriental ichthyologists to discover any special adaptation for drop-shooting.



"Blow-pipe" of Archer Fish

The groove-tube which enables the archer fish to project pellets of water from its mouth: a narrow slot in the roof of the mouth which is closed by the tongue



When the odd shaped tongue fits against the roof of the mouth a slender tube is formed, which is less than a sixteenth of an inch in diameter in a fish that is seven inches long

We are now ready to appreciate how the shooting fish operates. With the tongue closely pressed against the palate, the sudden compression of the gill covers will force water from the pharynx into the palatine canal; and with the tip of the tongue acting as a valve, the flow of water under pressure from the anterior end of the tube is regulated. It is the obvious habit of the fish to coördinate the compression of the gill covers with the momentary lifting of the tongue from the anterior end of the tube, permitting the escape of a single drop of water. With the jaws partly separated and the mouth reaching or projecting slightly above the surface, the drop of water is ejected with a force and for a distance that depend on the pressure. It is easy to understand how, with the pharyngeal cavity serving as both a reservoir for water ammunition and a compression chamber, it is possible for the fish to shoot drops of water in quick succession, as has been frequently observed, or the water may be expelled in the form of a jet when the valve is kept open longer.

Vision

The drop-propelling function would be useless if Toxotes did not possess, in addition, the ability to use its eyes in the air and to gauge accurately the distance, size, and suitability for food of small creatures flying or resting near the water's edge. It is an outstanding point that, for a fish, the aerial vision of Toxotes is very keen; and it was always a surprise to me to note the readiness with which insects and spiders were sighted as the fish explored the vegetation on the bank of a pond or stream.

The extent to which the fish's head projects at the surface of the water during the shooting act depends on circumstances. In muddy water the eyes must be at the surface in order to permit a good view and accurate aim; in clear water only the tip of jaws need project.

The chief accomplishment of the archer fish has been developed and is exercised in order to obtain living food consisting chiefly of insects. Enough has already been stated in regard to the general habit, but some definite references to food and feeding may be of interest.

This fish, with shapely, compressed body propelled by its broad caudal fin, is a graceful swimmer, moving quickly without apparent effort. It regularly swims at or just below the surface, and may go a long distance in a perfectly straight line, making a wake with the tip of its jaws. This wake is characteristic and enables an observer to detect the presence of a fish even before he has actually seen it.

The habit of swimming at the surface is ascribable to two circumstances: the food on which the fish chiefly subsists is obtainable there, and the eyes, on which the fish largely depends, could not otherwise function properly, for during most of the year the waters in which Toxotes lives are very muddy or turbid and aquatic vision is much restricted.

While Toxotes prefers the live food which it shoots for itself, it regularly eats shrimps, insect larvæ, and other creatures living in the water and insects that have fallen into the water. A large nest of carpenter ants impaled on a stake in a pond provided food for fish for several days as the ants fell into the water and were eagerly devoured. Under both semi-domesticated and wild conditions the fish does not reject bits of raw and cooked meat, fish, crabs and prawns; specimens which I had in a pond regularly came to be fed on raw chopped pork and fish.

In Siam, Toxotes is often sought by anglers, who use a light rod and line, armed with a small hook baited with a shrimp or insect. Favorite resorts for the fish—and hence for anglers—are the inlets and outlets of canals, near locks. A person in a small boat, casting his hook well away from the boat and doing nothing to frighten the fish, may often catch many at one place. The food value of the fish is high.

Toxotes versus a lizard

Once, in Bangkok, I saw a baby lizard, sunning itself on a vertical timber of a dock a few inches above the water, dislodged by a surprise shot of a Toxotes operating at point-blank range. As the lizard fell it was promptly grasped, but there may be doubt whether it was actually consumed. The cavity of this fish's mouth is too narrow and the sides are too rigid to permit the passage of a large mass of food; and it is apparent that seized insects and other food must first be reduced to a slender bolus between the tongue and the various bands of minute teeth on the roof of the mouth before swallowing is possible.

Some of the standard modern works of reference and text-books make inadequate or misleading allusion to the exercise of the shooting power. Thus, when the *Cambridge Natural History* states that "*Toxotes jaculator* derives its name from its habit of capturing insects flying over the surface of the water by shooting drops of water at them," it overlooks the much more common and characteristic habit of stalking insects that are resting on plants in the water or at the water's edge. In reality, insects shot on the wing represent a very small percentage of the total food intake. In Siam, Toxotes was very rarely noticed in pursuit of flying insects. On the few occasions when I observed this habit there had been an irruption of winged termites and the fish were very active in chasing the low-flying insects across a pond or water-course and directing a perfect barrage of shots if necessary to bring down the prey.

In "The Biology of Fishes" (1926), the author, H. M. Kyle, observed that "the taste for flies has become so great that one fish has developed into an expert sharp-shooter in stalking and smothering flies—with a drop of water and mucus." If "flies" can be interpreted as including ants, bees, termites, grasshoppers, moths, caterpillars, dragon-flies, beetles, cockroaches, ephemerids and many other kinds of insects, as well as spiders, the statement is correct with the exception that insects are not smothered and there is no mucus in the watery pellet.

Marksmanship

The range, accuracy, and force of the shooting powers of Toxotes always excite surprise and admiration. In my experience in Siam the distance within which the fish could always be depended on to score a direct hit was three and a half to four feet. A much longer effective range has been recorded. Two fishes in the New York Aquarium could without difficulty hit a small cockroach at a measured height of five feet above the water.

Failure to hit a resting insect within proper range may be due to movements of the vegetation or, in the case of a spider dangling on a thread, to swaying caused by wind. When the first shot misses a mark, other shots usually follow in quick succession.

The force with which the watery pellets may strike an object is sometimes most astonishing to a human observer. An insect may be knocked high in the air or may fall on the bank beyond a fish's reach. At short range the drops may strike a person's face with a distinctly stinging sensation. On many occasions, during exhibitions in Siam, a spider at the end of a thread hanging from the end of a pole was knocked far up on the thread or even over the pole. Spent shots could be heard to splash against the roof of a veranda over the water.

The shooting habit begins to develop early and may be observed in fish only an inch long. It it most amusing to see the inexperienced youngsters emulating the actions of their parents and sending out tiny drops which may go only two or three inches. In half-grown fish the habit is well developed, but the highest expression of the shooting powers as regards accuracy, force, and range is to be seen only in the fully matured fish.

A peculiar feeding trait was exhibited by both river fish and pond fish in Siam when a spider on a thread was lowered to within about one foot of the surface of the water. A fish, which may have been shooting at the spider when it was two or three feet distant, would with little apparent effort rise vertically from the water and seize the lure in its mouth, sometimes holding on when the line was raised several feet. This was done so readily and regularly as to suggest a normal habit, although as a matter of fact I never saw it tried on insects hovering near the surface or resting on plants. Probably spiders and caterpillars hanging from their threads are the principal victims of this method of attack.

The writer's acquaintance with this fish was formed in the Philippines, French Indochina, Siam, Malaya, Burma, and India, but chiefly in Siam where it is common over most of the country and is called *pla sua,* or tiger fish, in allusion to the black crossbands on the yellow sides. Wild fish planted in a large pond in the compound of my residence in Bangkok were under close observation for a number of years, and were a source of pleasure and instruction to myself and many foreign visitors and residents.

Intelligence

Among all the oriental fresh-water fishes with which I am acquainted in the wild state, none gives such an impression of intelligence and efficiency as does Toxotes. This impression grows on an observer as he notes the purposeful way in which a fish moves about in a stream, canal, or pond; the zeal and thoroughness with which it explores aquatic and overhanging land plants for insects; the high development of its sense of sight in both air and water; the skill displayed in dislodging insects and seizing them as they fall into the water; the alertness in avoiding danger; and the readiness in adapting itself to life in small ponds and responding to the attentions of persons who provide food.

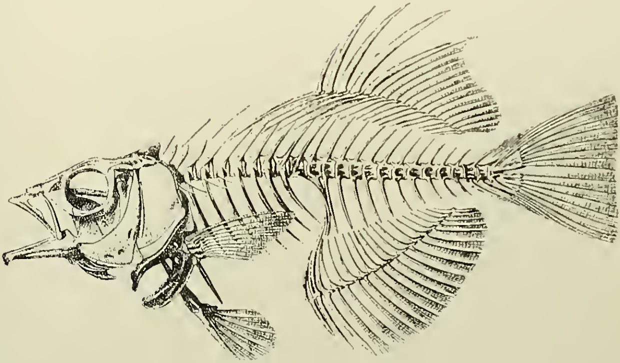
For the amusement of guests

A friend of mine, a distinguished scion of the royal family of Siam, and an ardent student of fishes, had a residence on the broad

Menam Chao Phya above Bangkok and used to entertain American and European guests with shooting-fish performances. A veranda on which he took many of his meals was directly over the water, and under it Toxotes could be found almost daily, attracted by scraps of fish, meat, chicken, and prawn which were regularly thrown from the table. By means of a spider or cricket dangled on a black thread from the end of a short bamboo pole, the shooting fish could readily be induced to display their marksmanship, and scores of foreign visitors, during the years I passed in Siam, were thus edified and amused. It was there that I sometimes saw spent watery pellets splash on the ceiling of the veranda ten to twelve feet above the river, and witnessed many other exhibitions which confirmed my respect for the intelligence and skill of Toxotes.

Carrying it too far

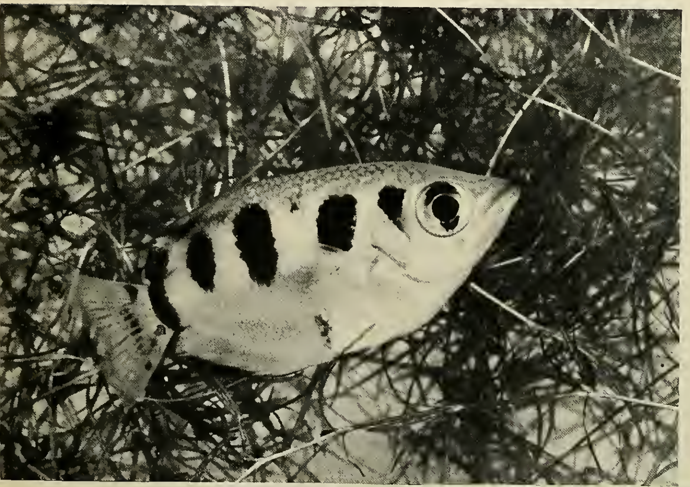
On two occasions to my personal knowledge, when my friend sat on the veranda eating his breakfast, reading a newspaper, smoking a cigaret, and apparently neglectful of his fish wards, his attention was attracted by well-directed shots which extinguished his cigaret.



Skeleton of Archer Fish (After Agassiz)

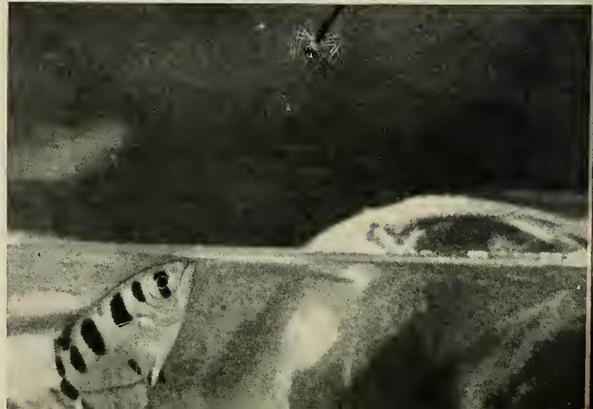
The Archer Fish

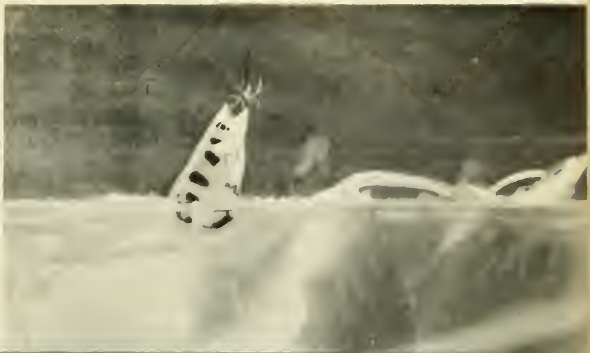
This curious fish makes its living by shooting insects with a drop or a short jet of water. Its aim is extremely accurate up to five feet, and if the drops strike one in the face at short range they produce a distinct stinging sensation. Shots that go wild carry ten to twelve feet. When maneuvering for a good position from which to "open fire," the fish frequently swims backwards; and its eyes, which are movable, sparkle with seeming intelligence. (It cannot definitely be stated that the specimen shown in these photographs is Toxotes jaculator, *the species commonly referred to.)*



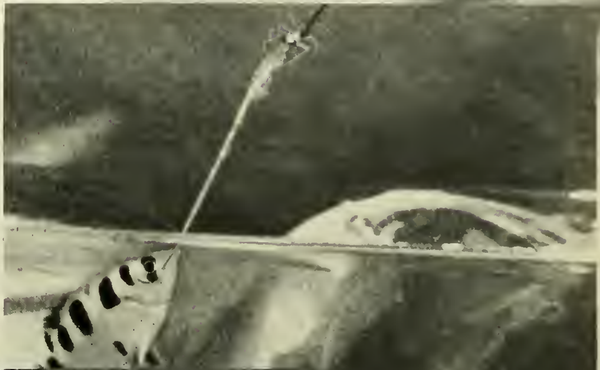
New York Aquarium, Dunton Photo

(Below) The archer fish preparing to shoot a spider



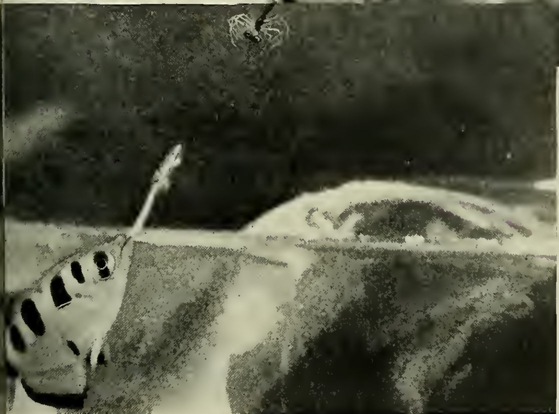


If the archer fish cannot get its prey in any other way, it will rise from the water and seize the insect in its mouth



An insect may be knocked high in the air, or may fall on the bank out of reach

The motion picture camera catches the shot in mid air

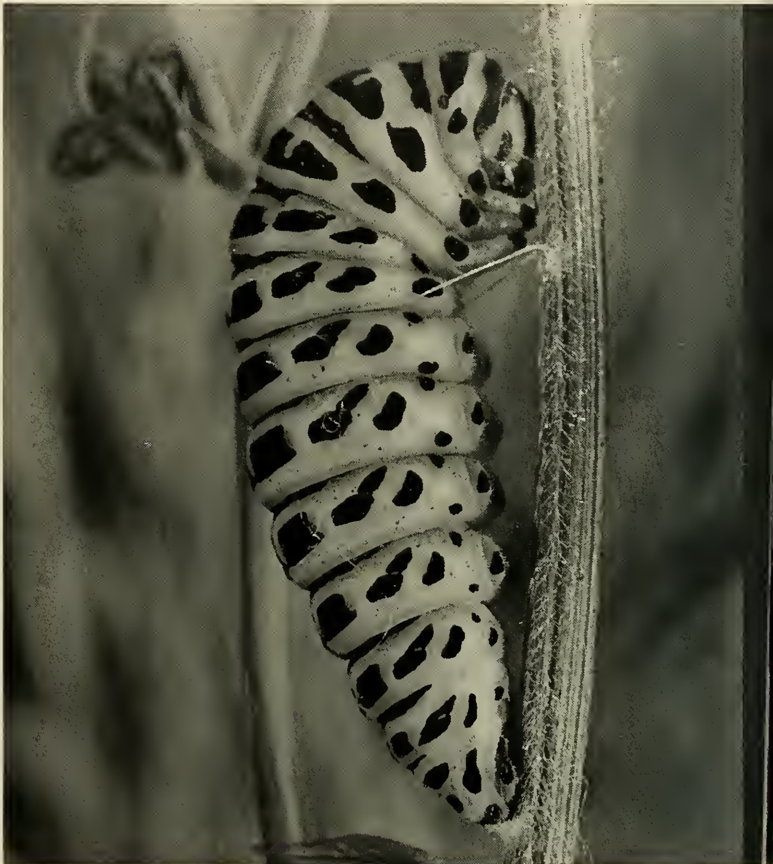


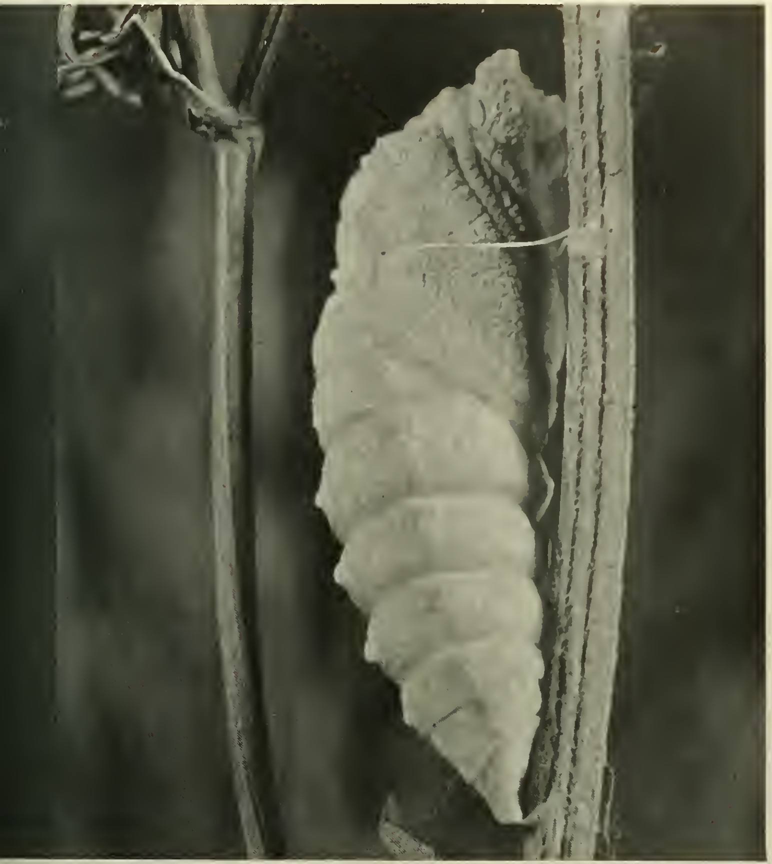
The author of the preceding article states that on at least two occasions to his knowledge a friend of his in Siam was sitting on his veranda beside a pool of archer fish, reading his newspaper and smoking an after-breakfast cigaret, when his attention was attracted by well-directed shots which extinguished his cigaret

ction photos by Pathé

Emergence of the Butterfly

In the following series of photographs the camera has enlarged the various stages in the development from the mature caterpillar to the adult butterfly. Although we show here the transition of a common European swallow-tail *(Papilio machaon),* the same changes take place in all butterflies. (The photographs employ more than one specimen to complete the sequence, but so regular is Nature that the substitution can scarcely be detected.)

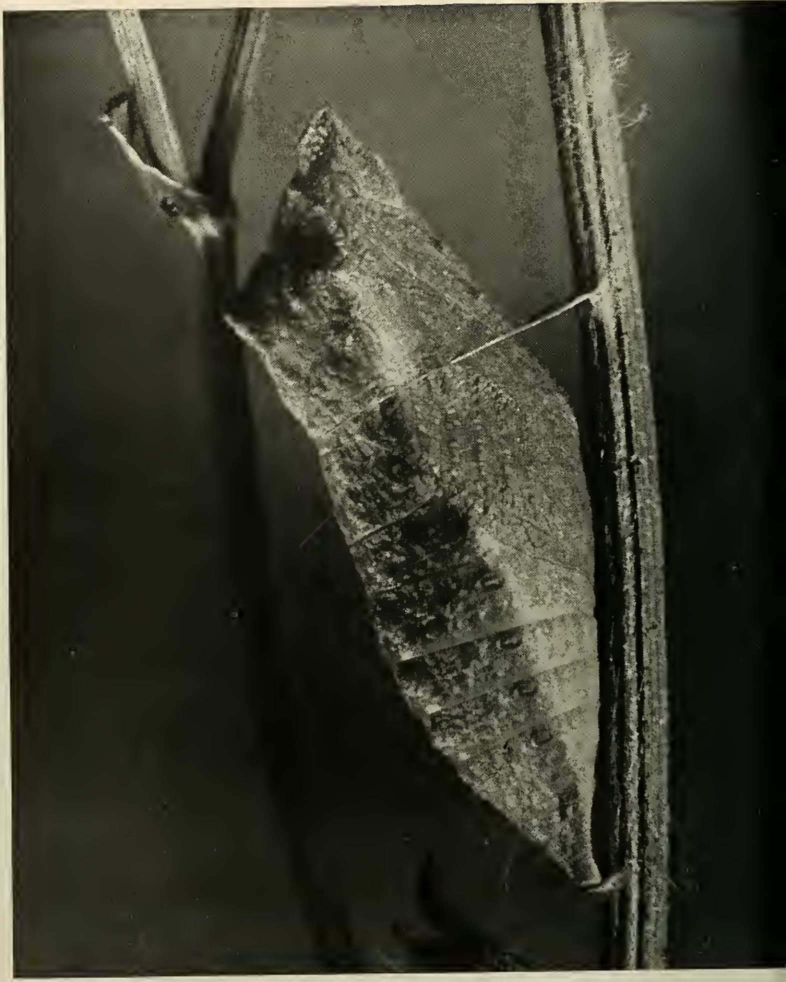




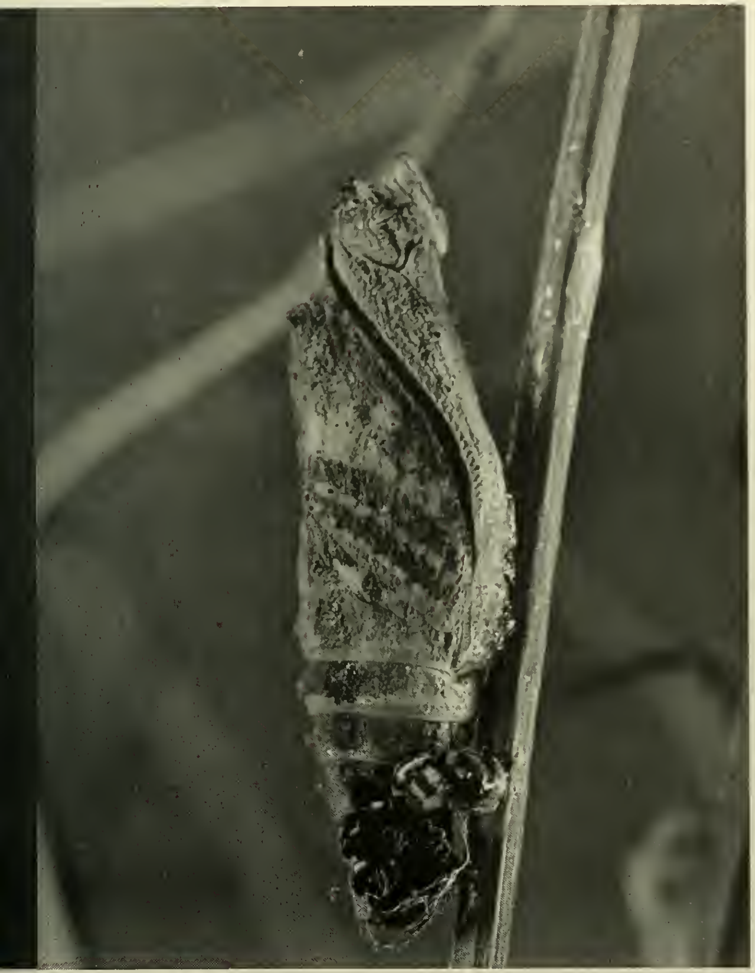
Photographs by Croy, from Black Star

(Left) The caterpillar has spent its time busily eating and has grown up enough to think of becoming a butterfly. It fastens itself by its tail to a plant by means of self-spun threads and thoughtfully provides a belt of the same material which is to prevent the pupa from changing its position. The actual length of the caterpillar is about an inch and a half

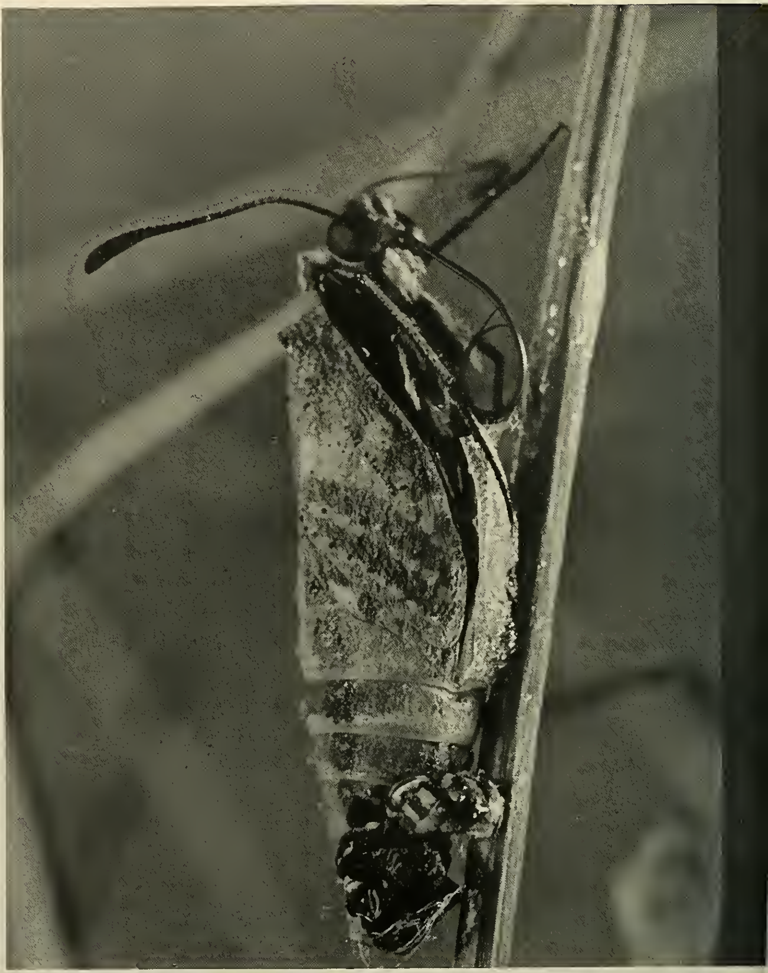
(Above) Shortly afterward the skin of the caterpillar splits open and the pupa emerges. Its shell is still soft and resembles the shape of the caterpillar



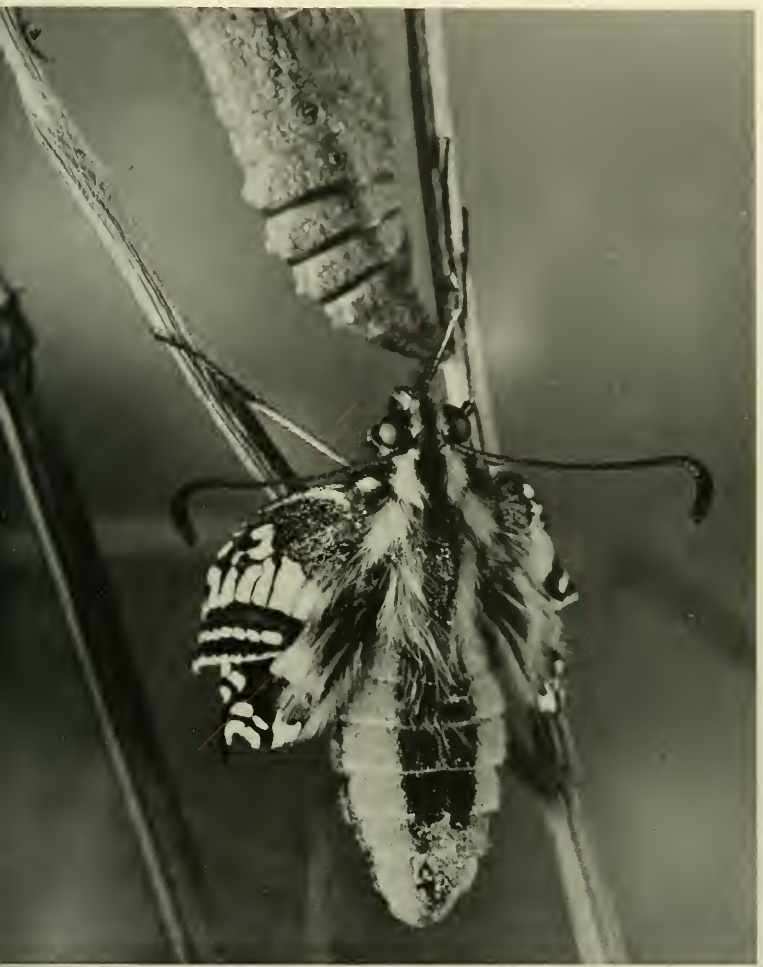
The pupa has acquired a hard shell which protects the soft interior where the change takes place. During this stage, that is so frequently referred to as the resting stage, all the internal organs of the caterpillar break down into a uniform liquid mass and then reform in the shape of a butterfly containing all the essential organs



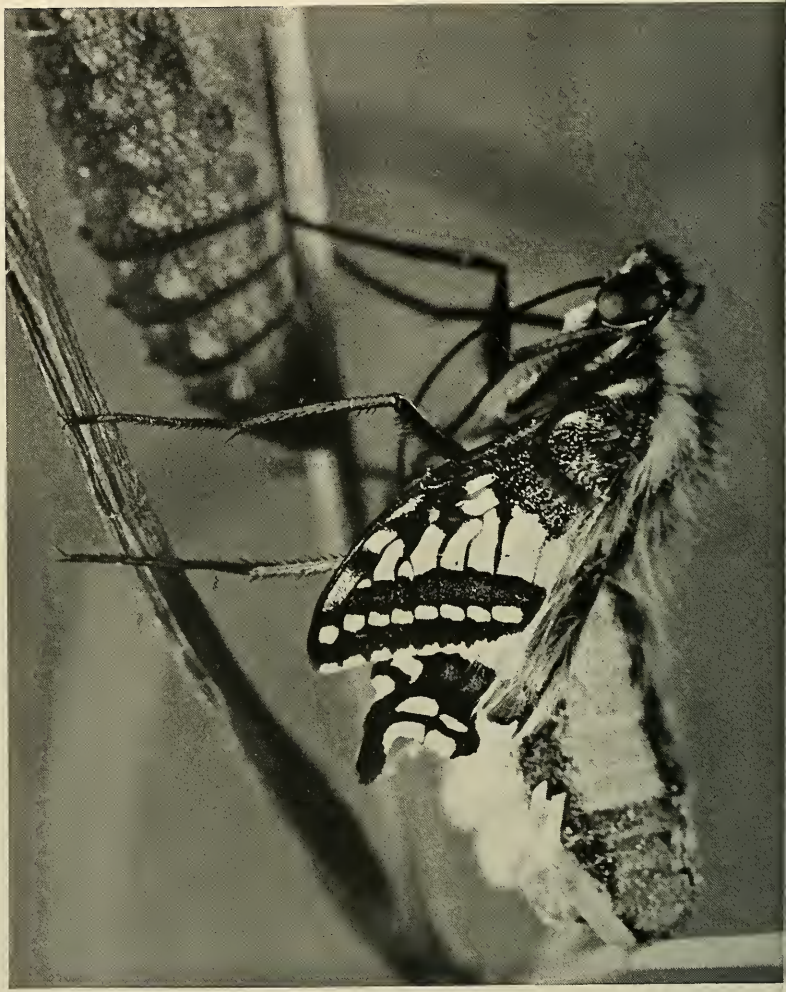
(Above) When the changes within the pupa are complete the hard shell bursts and the butterfly begins to emerge. The pattern of its wings are already discernible through the shell



(Above) The head piece is dropped and the butterfly sees daylight again in a new form
(Right) the butterfly is now freed, but

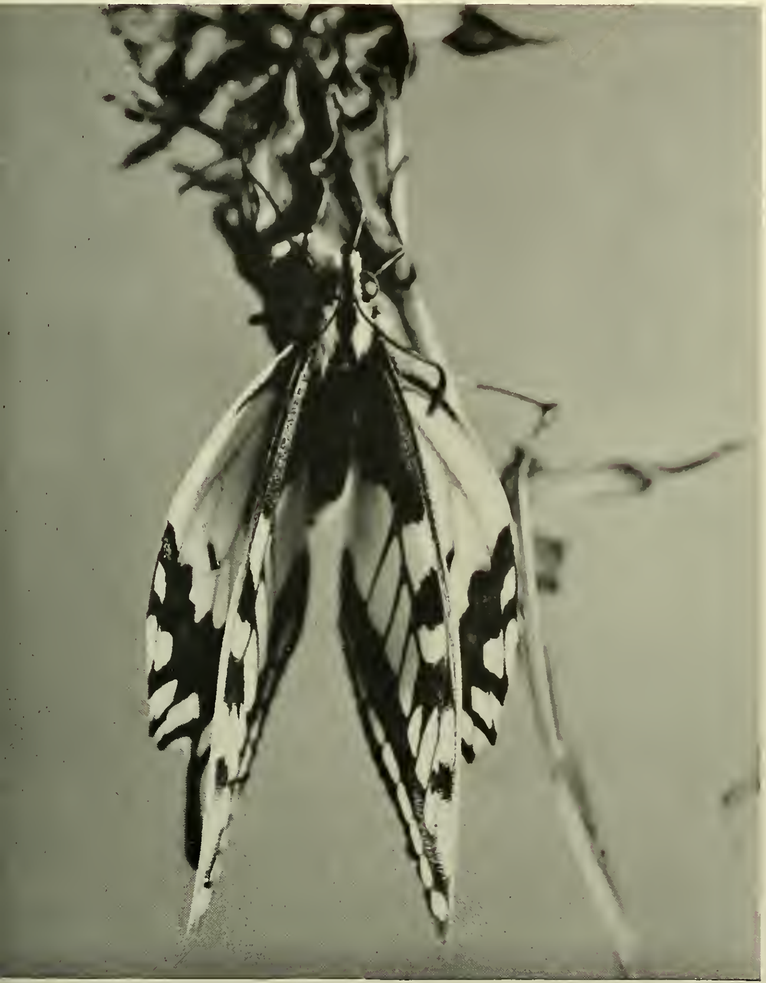


its wings are still soft little sacs of scale-covered membrane. These wing pads will be stretched to full size by the pumping of fluid into them

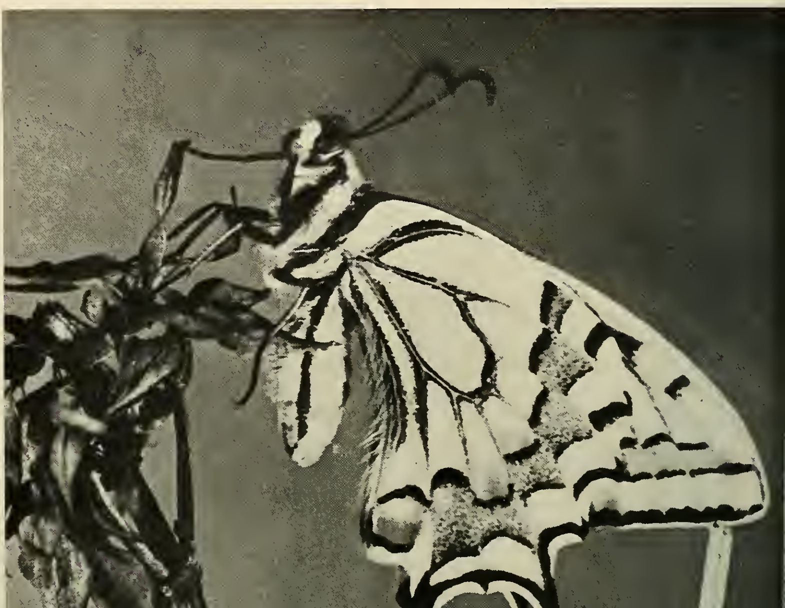


(Above) The wings blossom out quickly. From the time when the butterfly began to break out of the chrysalis until it has emerged and its wings are fully spread although not hardened is a matter of only twenty or thirty minutes

(Right) Before flight is possible the



wings must harden. They flutter spasmodically, probably hastening this process by increasing the rate of evaporation. The rate of hardening of the wings depends upon many conditions, including the size of the butterfly and humidity. Some small butterflies emerge and are able to fly in as little as ten minutes



The butterfly is fully developed, even the long tails of the wings are fully grown. It is a light yellow creature with black markings, and appears considerably larger than the inch and a half chrysalis from which it emerged

The Story of the Dinosaur Eggs

One of the epic tales of scientific exploration, told by a veteran of more than thirty expeditions

By WALTER GRANGER
Curator of Fossil Mammals, American Museum

THERE has recently been installed in the Mongolian exhibit at the Museum a group representing *Protoceratops*, the small hornless member of the horned dinosaur group, together with its nest of eggs. The two skeletons shown are real; the eggs are casts of a model made from a careful study of the Museum's collection of fifty more or less complete eggs, and they have been arranged in exactly the manner in which they occurred in one of the several nests discovered.

Behind the scenes

The finding of these dinosaur eggs has been told many times but it is an interesting story and will, perhaps, bear repetition at this time.

When the Central Asiatic Expedition first entered the Gobi, in 1922, it was not known definitely that dinosaurs laid eggs. Reptiles of today have both oviparous and viviparous methods of reproduction—even with closely related species of snakes some lay eggs and others bring forth living young, and it was supposed that since dinosaurs are reptiles, some of them, at least, might have laid eggs, although none had ever been found. At Rognac in southern France some fragments of what seemed to be reptilian egg shells were found in strata bearing dinosaur bones and there is a possibility that these are really bits of dinosaur eggs, but they may also belong to other contemporary reptiles. In North America, where dinosaurs flourished as nowhere else in the world and where their bones, their gizzard stones, their tracks and their toothmarks abound, not a trace of their eggs had ever come to light.

I presume that nearly every American collector of dinosaurs has been on the lookout for their eggs and has hoped that some day he might find one, or better still, a nest of them. I know that many times during the years I worked the dinosaur fields I visualized such a happening but as the years went on it began to seem such a remote possibility that it finally took its place as another futile day dream. In 1923, however, in the very heart of Mongolia, hundreds of miles from the nearest civilized community, this dream became a reality and we did find dinosaur eggs—not only single eggs but a whole nest of them, lying very much as the parent had left them seventy-five or more millions of years ago.

First dinosaur egg

The first discovery of these eggs came the year previous in 1922. On our way back to China in the autumn our party was passing near this locality, although not in actual sight of it, and the motor cars had been halted on the caravan trail to wait while the scout car ran off to the side to inquire the way at a Mongol village which we could see two or three miles distant. Taking advantage of this delay Mr. Shackelford, a photographer by profession but a fossil hunter by instinct, wandered off over the desert and soon came to the edge of the platform on which we had been traveling. He found that its face dropped off abruptly into a set of brick-red badlands, just the sort of place in which one learns to look for fossils. Climbing down into these rich-looking exposures, Shackelford was immediately confronted by a well preserved but somewhat weathered fossil skull with the jaws still attached and resting on a buttress of red sandstone. It was a simple matter for him to break the skull loose and he took it immediately back to the cars. It was identified at once as the skull of a reptile but its exact affinities were not determined until it was prepared in the Museum laboratory many months later.

This discovery seemed an important one to us and we decided to go into camp nearby and spend the remaining two hours of daylight in prospecting the locality. This prospecting resulted in the finding of many fragmentary remains of the same kind of animal. There was also picked up on the surface of the badlands a fragmentary and badly weathered egg shell which at the time was thought to be that of a bird, the eggs of which, although not common, are not really rare as fossils.

Later, when the bones collected that evening were determined at the Museum as belonging to a small member of the horned dinosaurs, it became evident that this badly broken and insignificant looking egg shell was actually the first positive dinosaur egg to be discovered.

Protoceratops andrewsi

The following year, realizing the full importance of these finds, we spent two months in scouring the area, named by us the Flaming Cliffs, with a large force of collectors, and we succeeded in obtaining several skeletons and more than fifty skulls of the little dinosaur which had already received the name of *Protoceratops andrewsi.* Of its eggs there were found many individual specimens mostly weathered out and lying on the surface, remnants of two or three nests where the erosion had left us only a small part of the original "clutch" of eggs and one nest where the erosion had only begun to make inroads and the greater part of the nest with no less than fifteen eggs was still intact. That was a great season for dinosaur eggs and while the scientific importance of the discovery was perhaps not so great as other discoveries made that year it did meet at once with popular fancy and did more than anything else to give the Central Asiatic Expedition public recognition the world over.

It may properly be asked, how do we know these are dinosaur eggs and how do we know they belong to this particular type of dinosaur known as *Protoceratops?* The answer is this: In the very limited area of Upper Cretaceous exposures at Flaming Cliffs extending along the face of the tableland for five or six miles we found upwards of fifty more or less complete eggs and thousands of egg shell fragments representing at least several hundred more eggs. They were to be found everywhere from one end of the exposures to the other and throughout the one hundred and fifty feet thickness of the deposit. *Protoceratops* was also very common and its bones were everywhere, frequently in close association with the egg shells. There were a few other types of dinosaurs found there but they were very rare and of types too small and delicate to have laid any but the smallest eggs found. Reptiles, other than dinosaurs found in the deposit, are a single tiny crocodile and a few small aquatic turtles—both out of the question as possible parents of the eggs.

It seems reasonable, therefore, to assume that the greater number of these eggs belong to *Protoceratops.* The eggs are of the right size, they have been found in close association and there are no other animals of this fauna, so far as known, to which they could properly be attributed.

The eggs which we have assigned to this diminutive ceratopsian vary from five to eight inches in length. In shape they are long ovate, an unusual shape for modern reptile eggs which are usually oval or spherical. The eggs are smooth at either end but the rest of the surface is covered with a fine irregular wrinkling as seen in the photograph of the single egg. The shells were undoubtedly brittle because all show more or less cracking which would hardly have been the case if they had been leathery, as some reptile's eggs are. In all cases the egg shells are filled with the same material in which they are embedded—fine-grained sand which had evidently filtered in after the shells became cracked, and had replaced the soft contents of the shell.

Why Outer Mongolia?

The question naturally arises as to why dinosaur eggs should be found in abundance in one restricted area in Outer Mongolia and nowhere else in the world, barring possibly the fragments of shells from France and a few other fragments recently discovered by Princeton parties in northern Wyoming. The only satisfactory explanation is to be found in the nature of the strata in which these Mongolian eggs occur. The deposit is a uniform, brick-red, fine-grained sandstone, so soft that it can easily be dug away with the finger nail. The geologists assured us that it was an aeolian deposit: that is, one laid down as wind-blown sand. At the time *Protoceratops* lived there it was evidently an area of drifting sand with probably a few small streams or ponds as indicated by the presence of the crocodile and the aquatic turtles. This then would account not only for the deposition of the eggs but for their preservation during the subsequent millions of years.

Eggs laid in circles

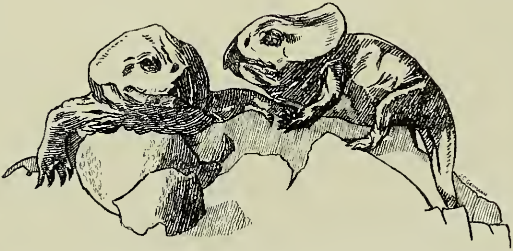
Sea turtles, of our time, come out of the water at night, climb up above high tide and there deposit their eggs in a pit in the sand and then after covering them carefully return to the sea, leaving the eggs to hatch by the heat of the sun. And so it is not difficult to visualize the female *Protoceratops* coming into the sand dune area, digging a pit and there depositing her twenty to thirty eggs at one time, covering them up and allowing the warmth of the sun to incubate them.

If one may judge from the several nests found, the arrangement of the eggs in the nest was always the same. They were in circles with the large ends up and tilted toward the center. In the case of the most complete nest discovered—the one used as a model for the group—there were five eggs in the lowermost circle and slightly above this was a much larger circle of eleven eggs. Still higher were the tips of two eggs indicating that there had been a third circle which if complete would have comprised about twenty eggs. The erosion of recent time, however, which had already removed the hundred or more feet of overlying sandstone, had reached the nest before the fossil collector came along and had sheared off the upper ends of most of the eggs and had very probably removed entirely all but two of the eggs of the uppermost circle. At any rate there were eighteen eggs represented and it is not unlikely that the nest originally contained thirty or more eggs. In another nest the erosion, working on a vertical face, had cut away just half of the eggs leaving fifteen still in the bank.

The orderly arrangement of the eggs in the nests may have been brought about by adjustment with the front feet or the beak, but it seems more reasonable to suppose that the female simply rotated her body as the eggs were deposited. The shape of the pit, being smaller at the bottom, would, of course, automatically regulate the diameter of the various circles of eggs.

75,000,000 years later

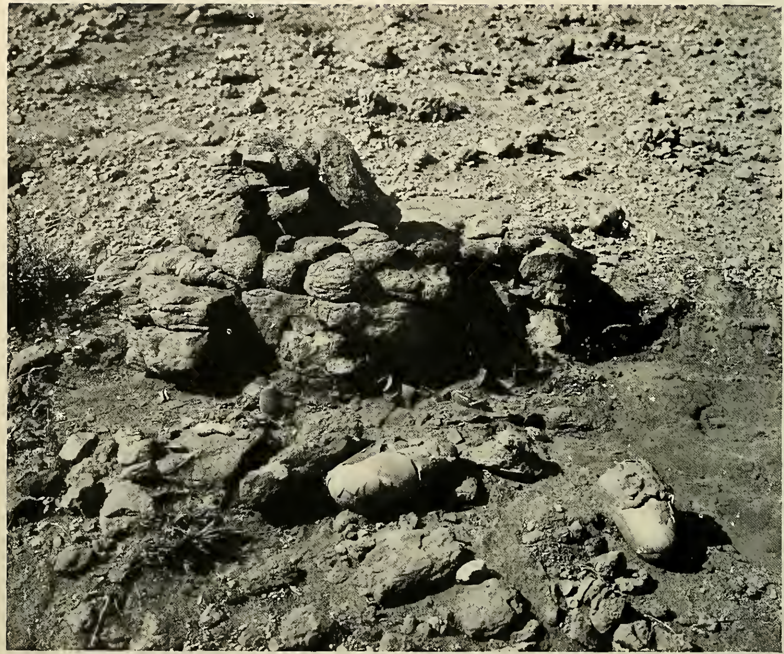
Obviously none of the complete eggs found had hatched, although two isolated eggs picked up on the surface do show what appear to be traces of highly developed embryos. It is quite possible that there may have been a sudden accumulation of drifting sand on top of the nest, which, if not sufficient to crush the eggs, would at least have cut off the heat of the sun and so stopped incubation, or there may have been other reasons which we cannot readily conceive. Whatever the reasons are, however, we are grateful for them because these particular nests, failures in the eyes of nature, have been handed down through seventy-five million years of geologic time to assist us materially in interpreting the life of that time and place.



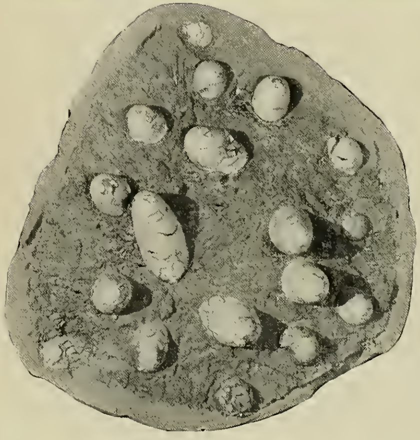
Baby dinosaurs emerging from the eggs

Drawing by John C. Germann from model by Mrs. E. Rungius Fulda

The Story of the

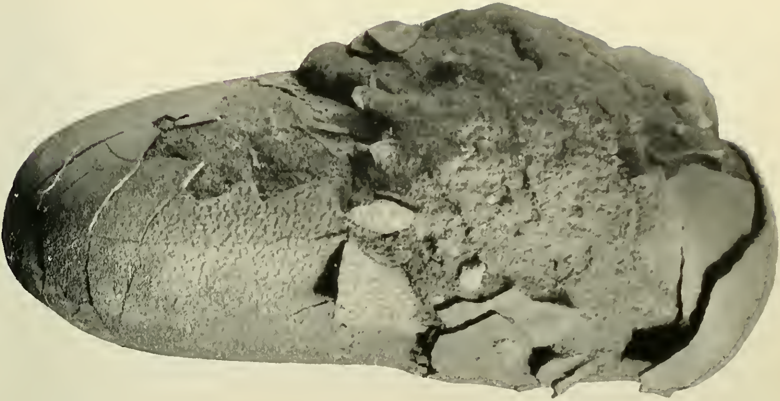


(Above) The first dinosaur nest discovered. One-half of the original nest of about thirty eggs was found under the sandstone mound; the other half had been eroded away but the eggs seen in the foreground had resisted the disintegrating process



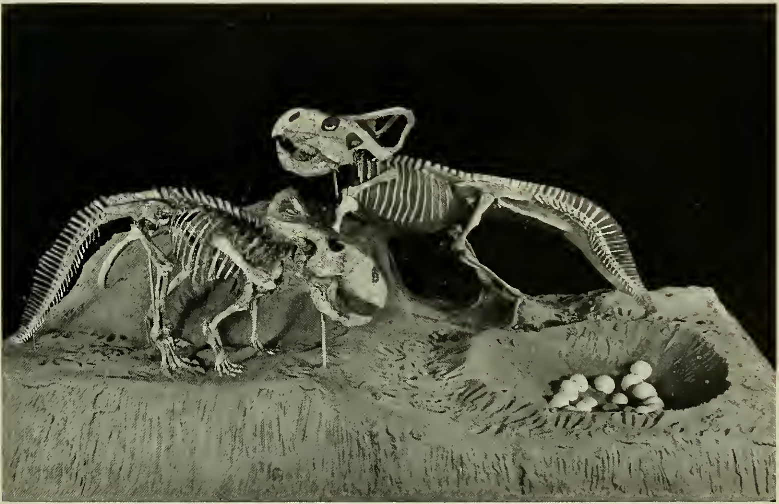
(Left) The underside of a nearly complete nest with the eggs still in position but worked out in high relief. Note an inner circle of five eggs and an outer circle of eleven eggs with the remnants of a third circle

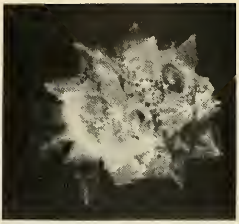
Dinosaur Eggs



(Above) 75 million years old. Filled with a fine-grain sand in which it was embedded this egg, smooth on both ends, has the rest of its surface covered with a fine irregular wrinkling

(Below) The newly installed Protoceratops *group. The skeleton in the background was prepared and mounted by the late Peter C. Kaisen; the other skeleton was mounted by Charles J. Lang who also assembled the group*

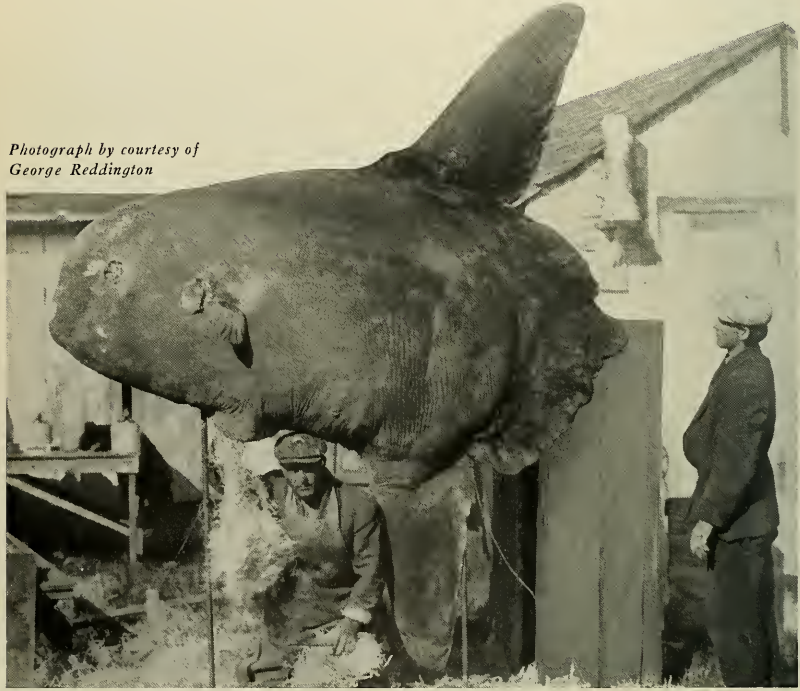




Photograph by courtesy of
A. Vedel Taning

(Above) The 1/10 inch larva of the pointed-tailed ocean sunfish: a speck of living matter from which the ten-foot colossus of the sea shown below developed. The tiny larva is a free swimming creature, able to find its own food. The comparisons which the author of the interesting article opposite draws, gives this fish a good claim to the title of growth-champion among animals

Photograph by courtesy of
George Reddington



From Atom to Colossus

Growth of the pointed-tailed ocean sunfish from one-tenth inch to ten feet,—an increase of 60,000,000 times its original weight

By E. W. GUDGER
Associate Curator of Fishes, American Museum

THE attention of New Yorkers in particular and of the readers of the metropolitan press in general has recently been called to the birth of a little bear cub in the Brooklyn "Zoo." This small chap was about 6 inches long and weighed 12 ounces. The mother probably measured 5½ feet from snout-point to tail-tip, and weighed about 200 pounds—these being the sizes for an average female bear.

Comparison among mammals

It has been estimated that a cub ordinarily equals about one two-hundredth of the weight of the mother bear; a puppy about one twenty-fifth as much as the mother; and a human baby about one-twentieth. In all these cases there is great discrepancy in size between baby and mother, but greatest in the bears.

This infantile descendant of the genus *Ursus* was in the course of nature born blind and hairless, and looking very unlike the bear he will grow up to be. Hence the fiction that the mother "licks the cub into shape"—a saying which by extension has come to be applied in a figurative sense to the young of the genus *Homo.*

The little cub referred to (and he was not only a cub but he *was* little) was taken from his mother and at first fed with a medicine dropper. Later, when he had grown a bit, he appeared in the news-reels as a bottle-fed baby who made strenuous remarks when his bottle was not forthcoming.

Most large animals give birth to large young, and contrariwise most small ones to small young—whether mammals or fish. But before considering the most unusual case in the fishes, and perhaps the most extraordinary in the animal kingdom, let us turn for a moment to a most interesting land-dwelling mother and baby, the difference in whose sizes is very great.

The contrast between the just-born kangaroolet and the mother is tremendous—in fact it is probably greater than that in any other land-living animal. The average mother kangaroo is three feet from crown of head to root of tail, while the baby, or "Joey" that is to be, has a similar measurement of about an inch. The mother weighs about 100 pounds (1600 ounces), the infant a mere fraction of an ounce. The young kangaroo is born in a condition even more unformed and more unlike the mother than is the baby bear. This in part at least accounts for the great disparity in size of mother kangaroo and her kangaroolet.

But great as is the contrast between the just-born kangaroo infant and the adult into which it will grow, a far greater difference is now to be considered—probably the greatest for any member of the animal kingdom living today. I refer to the contrast in the ocean sunfishes—young and adult.

The ocean sunfishes

To many of my readers the name sunfish calls to memory the little short-bodied perch-like fish of our fresh-water lakes and streams. These lovely little fishes are of at least half a dozen kinds and are perhaps our most common fishes angled for by every boy. But the pointed-tailed ocean fellow is not only a sea-dweller but is infinitely smaller when he is small and vastly larger when he is large—as we shall see.

The ocean sunfishes are millstone-shaped fishes and for that reason have been given the family name Molidae. Two of them, *Mola* and *Masturus,* grow to a size in which length (over the tail-fin) and depth (over the dorsal and anal fins) amount each to more than 10 feet, and they attain to a weight of from one-half to three-quarters of a ton. They are the largest fishes with the smallest eggs and littlest babies known to me. Yet it must be noted that, unlike baby bears and kangaroos, their microscopic young when hatched out of the floating eggs are born into the waste of waters able to seek and find their own food—to fend for themselves.

The smallest pointed-tail

Among the treasures gathered, by the Danish "Dana" Expedition of 1920, from the Sargasso Sea, that great "dead water" of the North Atlantic Ocean, is the smallest pointed-tail ever recorded. This we owe to that master deep-sea oceanographer and ichthyologist, the late Johannes Schmidt of the Marinbiologisk Laboratorium in Copenhagen.

The little fish shown in the figure is only about one-tenth of an inch long. The illustration is made from a photograph obtained by placing the tiny fish under a microscope. On the printed page, the fishlet is enlarged 10 times. It is what ichthyologists call a larval fish—that is, one quite unlike the adult, and which must undergo some extensive transformations in the course of its life history in order to become an adult.

To get an idea how tremendously small (the phrase is justified) this little fish really is, let the reader get out a foot-rule and look at an inch-space marked on this. This inch will be divided into both eighths and sixteenths. The little fish shown in the figure is larger than one-sixteenth but smaller than one-eighth of an inch. In fact it is about the size of a capital O in this type. It is the smallest free-swimming larva of any large fish known to me. It controverts the general rule that large animals have large eggs and young.

Our fish are called pointed-tails, but it is clear that there is nothing pointed in the tail of the microscopic larva. The dorsal and anal fins are very like those of the adult, but, instead of the central spade-shaped lobe of the colossus in the figure, in the baby the body ends like that of an ordinary young bony fish—in a stout stump with a paddle-shaped fin on the end.

But our pointed-tailed fish is *not* an ordinary fish, and in size and form the tails in the two ages are as far apart as the antipodes and as unlike as are the sizes and shapes of the two fish. The tale of how the tail of the little sunfish disappears and how the great and unwieldy tail-end of the adult *Masturus* comes into being, a tail-structure found in no group of fishes save the Molidae, or mill-stone fishes, is indeed "another story" which will be told in a technical article in another place.

The giant of the tribe of *Masturus* of the whole world is shown in the large photograph. For this photograph I am indebted to Mr. George Reddington of St. Augustine, Florida, in whose "Museum of Marine Curiosities" on Anastasia Island the fish is on exhibition. The readers of Natural History who go to Florida may at any time see it there.

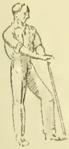
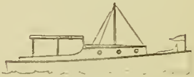
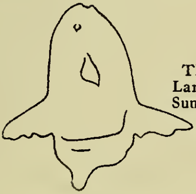
The colossus

This colossus among pointed-tails came ashore at St. Augustine Beach in 1912. There is today no definite record of its measurements, but Mr. Reddington has it that it was over 10 feet in length to the tip of the caudal "spade" as some call it, and 11 feet 3 inches deep over the great dorsal and anal fins. One can well believe this by comparing the height of the standing man with that of the fish. Today, after 24 years of drying and shrinking, the mounted fish measures 8 feet long and 9 feet 7 inches deep.

When fresh, this gigantic creature was too heavy and too unwieldy to be hoisted for weighing, but its weight was *estimated* at about 1700 pounds. This is probably too high a figure. But judging by my records of somewhat smaller specimens which were *weighed,* it seems likely that this great fish must surely have tipped the scales at over 1200 pounds. It is the largest and heaviest pointed-tail on record, a veritable giant.

Lest anyone think that this fish was a freak in size, it may be of interest to note that the next largest on record (also a Florida specimen, captured in a net off Daytona Beach in April, 1931) measured 8 feet 4 inches in length and the total depth was 8 feet 9 inches. Its great tail-fin, measured from the body

A Chart of Ratios to Show by Comparison with Other Living Creatures the Phenomenal Growth of the Larva of the Pointed-Tailed Ocean Sunfish

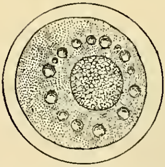
	A Child At Birth	is to	Its Mother	as	A 150-lb. Rowboat	is to	A Life Boat (3000 lbs.)
	A Puppy At Birth	is to	Its Mother	as	A 150-lb. Rowboat	is to	A Fishing Launch (3750 lbs.)
	A Cub At Birth	is to	Its Mother	as	A 150-lb. Rowboat	is to	A 36-ft. Cruiser  (30,000 lbs.)
	A "Joey" At Birth	is to	Its Mother	as	A 150-lb. Rowboat	is to	An Ocean-Going Tug (240,000 lbs.)
	The Larval Sunfish	is to	Its Mother	as	A 150-lb. Rowboat	is to	60 Queen Marys (The Queen Mary's Tonnage 80,773)

proper to the tip, was 2 feet 2 inches long. The lower side of the tail-lobe had suffered mutilation.

As the figure shows, the St. Augustine giant has a short rounded caudal lobe which has evidently been abbreviated. Examination of all published figures shows that almost all recorded adult specimens of this fish have mutilated tails. These sluggish and defenseless fish are readily attacked by sharks and barracudas, and the caudal lobe is the part most vulnerable and most often mutilated. Attention is called to the spots found on the great tail-fin. In almost all perfectly fresh specimens of the adult *Masturus* the body also is more or less covered with spots.

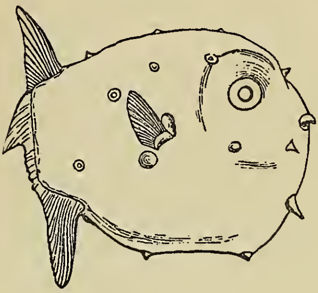
The egg

The reader has seen from what a microscopic larva (only about one-tenth of an inch long) our 10-foot colossus of the pointed-tailed tribe has grown. It would be interesting to know the size of the egg from which the larva of *Masturus* has developed. So far as I know no figure of such an egg has ever been published. But Johannes Schmidt has figured the egg of the first cousin of the pointed-tail, that of the truncate-tailed sunfish. This, shown in the annexed figure, was about one-twentieth of an inch in diameter—about half the size of a small letter o of this type. The fishlet which Schmidt hatched from this egg, when in the same stage of its life-history as our little fish, was practically of the same size and make-up as ours. I know of no other large fish which lays an egg anything like so small as this.



The egg of the truncate-tailed ocean sunfish, a cousin of the pointed-tailed fellow which grows so large. The natural size of this egg is about 1/20th of an inch in diameter. Here it is enlarged about 20 times.
(*After Johannes Schmidt*)

From all this it can be judged that the 10-foot colossus, shown in the large figure, developed from an egg about one-twentieth of an inch in diameter. What a prodigious amount of eating our great fish must have done! What its food is we do not surely know. This was long thought to consist of marine algae, but now the fish is known to feed in part upon the small transparent paper-thin larvae of the eel. But these are very small and likewise few and far between in the vast ocean. *Masturus* is, along with its cousins *Mola* and *Ranzania,* just about the poorest swimmer in the seven seas. Where and how it can find the larger and more abundant food out of which to develop its huge bulk, is one of the unsolved problems of the piscine world. With Shakespeare we may surely ask "Upon what meat hath this our Caesar fed that he hath grown so great?"



A 1¼ inch sunfish: a mid-way specimen which helped scientists to identify the "atom" as the offspring of the "colossus." Most such specimens are found in the stomachs of predatory fish; this one came from a kingfish in the middle of the South Pacific
(*After Günther*)

Islands West of South America

Further explorations on the schooner "Zaca."—To Selkirk's Juan Fernández, the rainless guano islands of Peru, and exotic Galápagos

By JAMES P. CHAPIN

Associate Curator, Continental Old World Birds, American Museum

OFF the coast of Central Chile, a little more than four hundred miles out, lie the Juan Fernández Islands. The "Zaca," on her return from Easter Island,[1] had over fourteen hundred miles of ocean to cross before reaching Mas Afuera, the outer island of the group. With the good weather we now enjoyed, this was a voyage of ten days. Various occupations made them pass pleasantly.

A few birds in the ice-box still had to be skinned. We could watch the sailors as they fished from the bow for bonitos, small cousins of the tuna, which swam abreast of the ship. Jaques and I could always scan the water for birds, seeing petrels of several species, an occasional red-tailed tropic bird, or a solitary gray noddy. We even hoped to see an albatross, but it soon became evident that they remain well to the south of the 30th parallel, except in the cold waters close to the South American coast. Our last red-tailed tropic-bird, characteristic Polynesian species, was noted about 440 miles west of Mas Afuera. From there on we were in American waters.

Landfall

The morning we approached Mas Afuera its high southern extremity, rising to some 5400 feet, was capped with clouds. Here was an island as precipitous as any of the Marquesas, with gray cliffs and grassy taluses, where numbers of goats could be seen grazing. The upper levels on the mountains showed a good deal of green bushy growth, but could scarcely be called well wooded, and the shores of the island seemed rather dry.

Its whole length is only eight miles, and we were soon anchored off the east side, opposite the old penal colony, abandoned some five years previous. I could not help contrasting our enthusiastic visit of a day with the enforced residence of those who had occupied the ten low buildings we found marked as offices, workshops, and *calabozos*. The headquarters of the *carabineros* suggested that the guardians may not have been much happier than the prisoners.

In such a place enthusiasm must vary inversely as the length of sojourn. In my case the only anxiety was to see as much as possible in so short a time. We knew that petrels must nest in burrows up on the mountains, and that there were several land birds: a large hawk, a hummingbird, a brown thrush, and two small brown birds of other South American families.

Island hawks

The hawks did not keep us waiting. Before we reached the landing-place two of them were seen flying about a large pine tree planted close to the buildings. Several more were found later, and although *Buteo polyosoma* is related to our North American red-tailed hawk, its representatives on Mas Afuera had no great fear of man.

Back of the penal colony a narrow valley, or rather a great gorge, extended inland. The brook in it had dried up to a series of stagnant pools, and about the rocks along it lived *Cinclodes oustaleti,* thrush-like in appearance but belonging near the oven-birds. Jaques and Doctor Lyman offered to cover this valley, while with Jack, one of the Norwegian sailors, I was to take the zigzag road up the ridge on the north.

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[1] This is the third and concluding article by Doctor Chapin, describing the Templeton Crocker Expedition to the South Pacific. Previous articles appeared in *Natural History* for November, 1935, and April, 1936.

What I sought were woods in which the other birds might find shelter. We climbed 1500 feet before the grasses became interrupted by huge ferns, like tree-ferns without trunks. A little later the path veered to the right and traversed a gully filled with the low woods we had seen from below. In such moist places there were also typical tree-ferns with trunks fifteen feet high. A tangled "maqui" tree with small purplish berries attracted a pair of thrushes (*Turdus falcklandii*), but I failed to find either the hummingbird or the spiny-tailed *Aphrastura masafuerae.*

Petrel nests

As we climbed higher through these woods we began to see the burrows of gadfly petrels. Great numbers of the birds had been seen over the ocean at daybreak, and here were their homes. Jack dug out a few of the holes without finding any occupied, but several dried carcasses lying near by were readily identified as *Pterodroma externa.* Another smaller species, *P. leucoptera,* is likewise known to nest on the island, probably at a higher level.

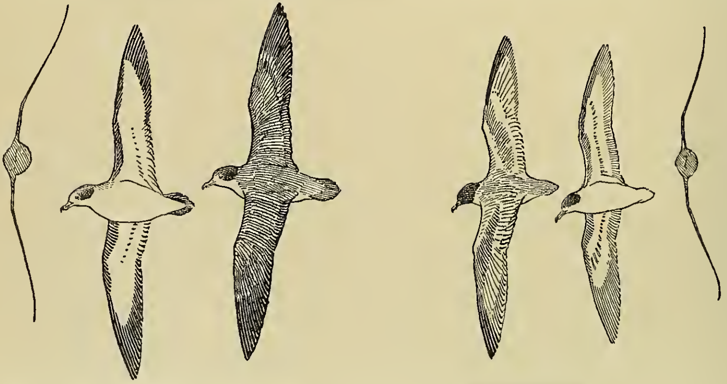
After crossing several wooded gullies, the trail ended near a rough shack with a corrugated iron roof. Inside, the ashes of a fire seemed not more than a few months old, and I felt as though I had stumbled on the abode of Robinson Crusoe. This camp was probably used occasionally by goat-hunters from Mas Atierra.

We walked uphill through open groves of trees with grass beneath, until these woods ended at 2200 feet. Above that there were clumps of tough ferns, four or five feet high, and a few tree-ferns with short fronds. As far up as we could see, ferns dominated the landscape. Looking down into a moist ravine, Jack spied some foliage like giant rhubarb leaves, five feet broad, with stems at least six feet long. So we climbed down to where these amazing leaves grew from a fleshy trunk that seemed covered with shaggy red hair. *Gunnera peltata* is a justly celebrated plant, and though native only to the Juan Fernández Islands, it has been grown widely in botanic gardens.

Off for Mas Atierra

To get down to the landing-place took little over an hour, and by five in the afternoon we were sailing away. Soon we were surrounded by the evening assembly of petrels, hundreds of them sailing low over the water, as they prepared to revisit their nests. The sun set directly back of the deserted prison-island, and we headed for Mas Atierra.

A schooner sighted shortly after midnight,



Two of the common Pacific types of gadfly petrel (Pterodroma), showing the upper and lower surfaces as they are seen when "banking" in the wind the second ship seen out of sight of land since we left California, was bound in the opposite direction on a fishing or hunting trip to Mas Afuera.

Early next morning Mas Atierra and its smaller neighbor, Santa Clara Island, were in plain view on a smooth ocean, with petrels of several kinds as well as shearwaters in view. At first these islands looked even more arid than Mas Afuera. As we approached the northern corner of Mas Atierra there were high cliffs, and then the Sugarloaf, a 2000-foot mountain with a tiny cap of woods and a few of the indigenous *Juania* palms.

A real Robinson Crusoe

Beyond Sugarloaf was a small bay with a cave in the rock near shore—Selkirk's Cave. It was here that Alexander Selkirk was put ashore in 1704, to live alone for four years and four months, and thus to provide Defoe with material for *Robinson Crusoe.* While the lower ends of the valleys still looked very dry, extensive woods could be seen inland at the bases of the mountains. There the island is far more richly wooded than any part of Mas Afuera.

Finally we came abreast of the village of San Juan Bautista, where a large white building on the shore was the headquarters of an important lobster company. The catch is shipped to Valparaiso. Behind the village rose mountains the highest of which is known as "El Yunque" in allusion to its anvil form. The higher end rises a little over 3000 feet.

Hugo Weber, one of the crew of the "Dresden," sunk in this harbor during the World War, came back with his wife a few years ago to live on a farm near the base of El Yunque. My day was spent in an excursion to Weber's farm, a clearing surrounded by beautiful forest; and there I met Charles Bock, a veteran collector of birds and plants. Our road led up through woods at first composed largely of "maqui" trees, introduced from South America, and now spreading with dangerous rapidity. Just before reaching the farm we came into the indigenous forest, with large trees of many species and undergrowth rich in ferns.

About the Weber's home were flower gardens that attract hummingbirds, especially the smaller green *Sephanoides sephaniodes.* Along a path at the edge of the woods we began to see the larger *Thaumaste fernandensis,* the species which had eluded us on Mas Afuera. The males are largely rufous, the females glossy green above, whitish beneath. Unless forewarned one would take them for two distinct kinds of hummingbirds. A favorite tree with this bird was *Raphithamnus venustus,* full of small tubular blue flowers. Whenever we noticed such fallen flowers, we would almost certainly find the hummers chasing each other or feeding overhead.

In swampy places in the woods Mr. Bock showed us a splendid patch of *Gunnera* plants, and likewise some of the rarer examples of the flora which he had transplanted from the higher mountains. Mas Atierra is an island to arouse the enthusiasm of a botanist.

As we left our anchorage early the next morning a school of six or eight killer whales escorted us for ten minutes or more. Two and a half days of very easy going brought us within view of the Andes, and only a few hours before we sighted South America Jaques saw the first albatross. It was near the same place, too, that small flocks of phalaropes began to show themselves. Probably of the species called the red phalarope, they were in gray-and-white winter plumage, looking for all the world like sanderlings when in flight. These lobe-footed shorebirds breed in the Arctic and then seek the southern summer at sea, even beyond the Tropic of Capricorn.

Birds of the cold current

We had almost failed to appreciate the narrowness of the fringe of cold water welling up in the Humboldt Current. The morning of February 4, 1935, we arose at daybreak to see the peak of Aconcagua, and in two hours were off the harbor of Valparaiso. The skuas, gulls, terns, pelicans, cormorants, and boobies characteristic of the cold water seemed almost to hug the shore. They all showed up when I was below, shaving, to Jaques' great amusement.

At Valparaiso we were back again in civilization—strikingly so. The influence of climate on human society here finds eloquent expression. Moreover, we were among friends. Local naturalists and American consular officials greeted us warmly, the press pictured us on the front page. We tied up alongside Mr. W. K. Vanderbilt's yacht "Alva," and I met my old friend William Belanske, his artist-preparator. A little farther along the mole was the Chilean training ship "Almirante Baquedano," the name of which we had seen painted on the Easter Island statues.

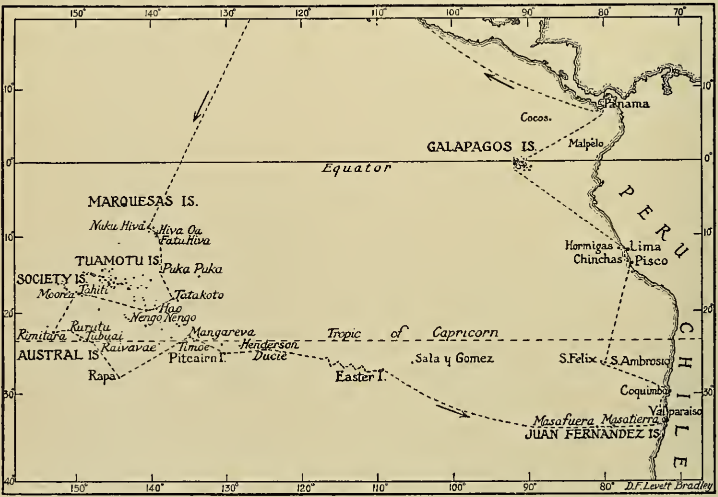
Our stay of eight days in Chile would deserve an article in itself. Suffice it to say that Mr. Crocker, Doctor Shapiro, and Mr. Jaques visited Santiago, and then Jaques and I made a two-day trip by train and auto to the Argentine frontier. From the base of the statue of Christ the Redeemer on a cold Andean pass we gazed upon the snowy summit of Aconcagua. In the afternoon Lincoln Ellsworth flew over us in a passenger plane from Mendoza to Santiago.

At Valparaiso we bade goodbye to Doctor Shapiro, whose work had been completed. Henceforth we would confine our attention to islands of no anthropological interest, but we were sorry to lose his ever-cheerful companionship.

If I was disappointed at seeing so few of the Humboldt Current birds before reaching Valparaiso, I had no regrets as the "Zaca" bore us northward along the coast to Coquimbo. Now we met the albatrosses, diving petrels, large skuas, black-backed kelp gulls, gray gulls, Inca terns, brown pelicans, guanay and red-footed cormorants, and Peruvian boobies. These are only the common species of the assemblage described so masterfully in Dr. R. C. Murphy's *Bird Islands of Peru.*

Coquimbo was our point of departure for the barren volcanic islands of the San Felix group, lying about 400 miles off the coast of northern Chile, near latitude 26° S. After a single night at sea no more cold-water birds were visible, and we began to see petrels like those of the Juan Fernández Islands. Another three days and we awoke to find ourselves approaching San Felix, having already passed the much higher island of San Ambrosio.

Eleven miles apart, they both are rocky and treeless, at first apparently devoid of vegetation. A third island, Gonzales, lies close to San Felix, as though they might be remnants of some old gigantic crater, now chewed apart by the relentless ocean. Flocks of sooty terns flew out to meet us, and a few white boobies with black wing-quills. The principal reason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GALAPAGOS IS.
Malpelo
Equator
PERU
MARQUESAS IS.
Nuku Hiva
Hiva Oa
Fatu Hiva
TUAMOTU IS.
Puka Puka
SOCIETY IS.
Moorea
Tahiti
Tatakoto
Hao
Nengo Nengo
Rurutu
Rimitara
Tubuai
Mangareva
Raivavae
Timoe
Henderson
AUSTRAL IS.
Pitcairn I.
Ducie
Rapa
Tropic of Capricorn
Sala y Gomez
Easter I.
Hormigas
Lima
Chinchas
Pisco
S.Felix
S.Ambrosio
CHILE
Coquimbo
Valparaiso
Masafuera
Masatierra
JUAN FERNANDEZ IS.
D.F. Levett Bradley

THE ROUTE OF THE CROCKER PACIFIC EXPEDITION

The "Zaca" which carried the party almost 14,000 miles through the Pacific, is a two-masted schooner, 118 feet over all. The present article describes the last leg of the journey, from the Juan Fernández Islands north to Panama for our visit was to make a list of the resident birds for Doctor Murphy. He had seen a poor photograph of a booby taken at San Felix, where they were said to have nested in great numbers before the Chilean earthquake of 1922. The only species of booby we saw here was this masked booby, *Sula dactylatra,* so the puzzle was solved.

The western end of San Felix is formed by a high yellowish hill of soft tufa. On this elevation we at last made out scattered low bushes covered with gray-green foliage. To the northwest of the anchorage a gray cathedral-like rock rose from the sea. The only landing-place on the island was a ledge beside a deep cave, where an old rope dangled down the low cliff. The rope had apparently been left by the training-ship "Baquedano," for its name was painted on the rock.

Ashore on San Felix

Our second officer climbed up the old rope and attached a safer one for me. With a sailor-companion I was then able to wander all over the dusty top of the island. Traces of a few old booby nests were seen, but only one pair still attended patiently to their egg, which was hopelessly addled. They may have been waiting months for it to hatch. The sooty terns and gadfly petrels (*Pterodroma cookii*) had practically finished nesting; all but a few of their young were on the wing. Gray noddies alighted confidingly on the rocks about us, but had no nests.

On the lower section of the island, built of successive flows of brown-black lava, there were low round bushes of purplish sea-blite, and a very few examples of a grass and a mallow. Four species of plants were all I could find. The only conspicuous insects were large flies which swarmed upon us, especially in the spots where colonies of terns had nested.

In the afternoon the "Zaca" took us back to San Ambrosio. Here the bare forbidding cliffs, hundreds of feet high, made me doubt that anyone had ever climbed them. The very top of the island, rising to 1470 feet, was well covered with greenish bushes, over which hundreds of large petrels *(Pterodroma neglecta)* could be seen circling. They evidently had a well protected breeding community there.

As night fell white-bellied storm-petrels (*Fregetta grallaria*) made their appearance around the yacht, as birds which had been feeding offshore came in to replace their mates on the nests.

I have since learned to my surprise that in 1869 Simpson reached the summit of San Ambrosio and brought down in his hat specimens of its plants. Seven of them do not occur even on San Felix.

To the guano islands

Our next port was Pisco in Peru, just inside the Chincha Islands, the best known of all the guano islands. Here millions of seabirds unwittingly add to the revenues of the Peruvian Government. We were to collect materials to show the guanay cormorants. *(Phalacrocorax bougainvillii),* Peruvian boobies *(Sula variegata),* and brown pelicans *(Pelecanus thagus),* which nest on these rainless islands in incredible numbers. In prehistoric times their excreta raised the elevation of one of the Chinchas by 180 feet.

During the nineteenth century this accumulation of fertilizer was dug down and exported even to the opposite side of the earth, its exploitation sometimes accompanied by the utmost brutality toward the workers. Moreover, the birds themselves were dangerously depleted in number before the government of Peru awoke to the wisdom of protecting the birds to insure a permanent supply of guano.

Now, before landing on the Chinchas, we would need a special government permit. Thanks to my colleague, Doctor Murphy, and his good friend, Señor Ballén, director of the government guano administration, this permit was awaiting us at Pisco. So we recrossed the bay, plowing through a great flock of "guanayes" busy with their fishing, and anchored between the North and the Central Island.

We were greeted by the guardians of the islands, whose chief inspected our official papers; and they began by showing us over the Central and South Islands. The North Island was black with a new brood of full-fledged "guanayes" or cormorants, and from morning till night their parents streamed out in long lines toward the fishing grounds.

Around the cliffs were the colonies of Peruvian boobies or "piqueros," and on top of these declivities sat rows of huge brown pelicans, at once sedate and foolish-looking. On the wing they would become majestic. Low down on the rocks flocks of Inca terns with white ear-rings of feathers took their repose, while there, too, and especially near caves, one might see small parties of Humboldt penguins.

The Central Island had only a small colony of '"guanayes" still sitting on their nests, and the same was true of the South Island, which had recently undergone a "harvest" of its guano. No blade of grass or twig of a bush could be found on any of the three islands. But cormorants must have nests, so these utilized the cast-off wing and tail quills of their own kind, building a soft if filthy cradle in which to lay their eggs. Most of the nests held newly hatched young, ten times homelier than any ugly duckling, with small black heads and snaky wrinkled necks.

Planning a bird group

Jaques, with practiced eye and previous experience of the Peruvian islands, quickly chose the south end of the South Island for his background, with the Ballesta Islands and San Gallan in the distance. It was my sorry duty to gather the specimens to be placed in the foreground of the group. Nothing but birds painted in the background can ever give an idea of the numbers of sea-birds about these islands.

Down below us on the stony beaches dozed hulking bull sea-lions, with their smaller mates and progeny. The protectors of the birds, I am sorry to say, frequently shot the sea-lions; yet the latter seemed in no danger of extermination. In three days we went over the islands thoroughly, taking photographs, collecting the number of old nests needed, and what few other accessories could be had. Nearly all my birds were obtained over the water. Ashore the air was frequently nauseating, and even as the "Zaca" left to sail northward toward Callao it passed to leeward through a fog of white dust and down-feathers.

The following morning, as we rounded the mountainous island of San Lorenzo to enter the harbor of Callao, looking in vain for a possible condor, the guano birds were all about us. Our stay of four days, with frequent visits to Lima, was largely devoted to sightseeing. An Exposition of the Fourth Centennial of the Founding of Lima was in progress, where ornithological exhibits from the University Museum were on view, including a habitat group of guano-producers.

Right after leaving Callao we paid our farewell visit to a pair of small but remarkable bird-islands. Some thirty-five miles offshore are the "Hormigas de Afuera," the "offshore ants," low bits of rock where guano cannot be gathered because of the dangerous surf. Their tops would be pure white were it not for the army of "piqueros" nesting on them, leaving room only for a herd of fifty sea-lions on the larger one and ten more on its smaller neighbor. There were also, to be sure, a small group of twenty "guanayes," and some Inca terns on rocks too steep for the larger birds. Strings of "piqueros" kept flying in until we were watching them cross the red disc of the setting sun.

On all sides the breakers roared, sending their spray higher than the dark rocky wall of the islets that rose only twenty-five feet above sea-level. Any attempt to land would have been foolhardy, so we were unable to learn anything of the nesting of the small storm-petrels which appeared after sunset. Rollo Beck had had the same experience here.

Isles of the tortoises

That evening the "Zaca" set out for the Galápagos Islands, about a thousand miles to the northwest, where the ocean water is some ten degrees warmer than that of the Peruvian coast. Consequently the sea-bird fauna is almost totally different. Now it was early March in 1935, and I was to revisit the islands where I had gone five years before as a guest of Vincent Astor on his yacht "Nourmahal."

Some of my friends, even after visiting the Galápagos, describe them as cool and comfortable, despite their equatorial location. I am a violent dissenter, in so far as the months of March and April are concerned, when my visits occurred. Other seasons may be different. Shortly after the turn of the year the rains arrive in the archipelago, the air warms up and becomes sticky. A cooling breeze may blow on the beach or over the mountains, but nowhere have I ever been more freely bathed in perspiration than while finding a way amid the cactus thickets of the Galápagos, just back from the shore.

Yet these islands are superlatively attractive to a naturalist, more so than the beautiful ones we had visited in Polynesia. Life is so much more abundant on them. Giant tortoises are still to be found, land-iguanas with the bite of a steel trap, other iguanas diving for seaweed in the ocean, hawks without fear of man, mockingbirds and flycatchers bold and inquisitive, pretty doves most peaceful of all, and the smallest barn owls in the world. Among mammals there are sea-lions and a few surviving fur-seals, but only a couple of species of native rats.

The avifauna of the Galápagos, first studied by Charles Darwin in 1835, is now exceedingly well known. It offers wonderful examples of the efficacy of isolation in the origin of species and subspecies—much more complex, probably, than Darwin suspected. In the celebrated case of the finches *(Geospiza* and allies), while a few species are restricted to a single island, the majority are found on several islands, and may or may not be divisible into local races.

Indefatigable Island, for example, is inhabited by eleven species of these small birds. It would seem that species first developed through isolation and later came together without interbreeding. One may claim that every step in the development of a species, or even a genus, can be followed.

Our party could not undertake an extended survey. The task was to select a spot well stocked with land-birds, with suitable scenic properties, and to collect all that would be needed in the Whitney Hall.

Approaching from the southeast, passing Hood Island, to my regret, at night, we sighted first the southern end of Albermarle and continued around the western side. The first afternoon a landing was made on a rather barren lava-field just south of Elizabeth Bay, where a few small Galápagos penguins were the birds of greatest interest. Consorting with tropical brown pelicans, yellow warblers, and an egret, these penguins were a paradox in an order of birds so often associated with bleak coasts and Antarctic ice.

Aims in the Galápagos

Our next stop was in Tagus Cove, also on Albermarle Island, its steep rocky wall adorned with forty-seven names of yachts and tuna-fishermen in white paint. To "Zaca, 1932" was added "1935." Below these mementos sat groups of marine iguanas, four large brown cormorants *(Nannopterum harrisi)* with wings too small for flight, pelicans, blue-footed boobies, turnstones, and wandering tattlers. No penguins were visible; I fear that they had all been exported to zoölogical gardens. A brief excursion convinced us that neither the thin bushy vegetation nor its resident land-birds were adequate for our group.

More flightless cormorants and penguins were seen on the north shore of Narborough Island before we circled the north end of Albermarle to double back toward Indefatigable. At James Island, on the way, we stepped ashore in a particularly well wooded bay; but eventually we chose a site for our group at Conway Bay on the northwest side of Indefatigable Island.

Plants and birds

The rough lava hillocks here bore low woods of *Bursera* and other trees, with large cacti of two kinds. Finches were numerous and varied, a very conspicuous black species clambering about the *Opuntia* cacti, pecking at flowers or fruit. Other kinds ate berries and seeds, or devoured the green caterpillars so abundant at this season. Leaves were growing rapidly on the trees, showers were not infrequent.

The view northward included so many islands as to give a vivid impression of the Galápagos as an archipelago. Frigate-birds, brown pelicans, blue-footed boobies, and lava gulls were passing continually. Mockingbirds came to inspect Jaques as he painted the scene in oil under a canvas shelter. Blue-black martins came flying over from Eden Island.

Nearly two weeks were required to complete our work. Fresh bird-skins were desirable, as well as many sections of woody plants and cacti to be reconstructed in the foreground. Some of the crew aided us ashore, others ran the small boats to and from the yacht, and under Mr. Crocker's supervision every detail was organized for comfort and efficiency.

My rat traps here caught nothing except introduced black rats. One evening I found the sailors collecting the tropical clawless lobsters in the rocky shallows. About fifty of them were boiled in sea-water in a large iron barrel, and never have I tasted better lobster.

But the cloud of mosquitoes around the fire was almost unbearable.

At Conway Bay our bird-group work was ended. We still had time to visit Academy Bay on the south side of the island, where an unsuccessful attempt had been made to found a Norwegian fishing station. The governor of the archipelago was there on a visit, and among the several European residents were Stampa and Wold, who had assisted us during the "Nourmahal's" visit in 1930. In that year there were but three men living on Indefatigable.

An old friend

The third was Elias Sanchez, an Ecuadorian, whom we had discovered hiding behind the banana plants on a farm in the interior. He was watching us, and very suspiciously, until Kermit Roosevelt addressed him in Spanish. Now in 1935, along the trail leading inland, I again came face to face with Sanchez, beaming with joy at our meeting.

The population of Academy Bay has now increased to about twenty-three, including Mr. and Mrs. Rader, Messrs. Finsen and Worm-Müller, Scandinavians, and Mr. and Mrs. Küppler, Germans by birth.

The place used to be celebrated for its hawks, forty or fifty of which could always be seen sitting around on trees and buildings. They were so tame that not only could they be snared with a loop on a pole, but actually induced to perch on a rake and lifted a few feet down before they took wing to regain their perch.

We know that the principal food of this bird (*Buteo galapagoensis*) is huge centipedes; but because of fear that it might attack chicks, it has been slaughtered until now one sees but four or five in a day. The doves (*Nesopelia galapagoensis*) have disappeared for another reason; they were too palatable.

It must be added, however, that the Ecuadorian Government has recently set aside as wild-life reserves a great many of the uninhabited islands. The strict regulations against destruction of the native fauna there should prevent extermination of any of the remarkable species.

Our last morning in the archipelago was spent at Darwin Bay on Tower Island, where a populous colony of frigate-birds breeds unmolested year after year. They are all of one species, *Fregata minor*, whereas on Indefatigable Island only *Fregata magnificens* was commonly seen. When a ship enters Darwin Bay a flock of these great soaring birds gathers above it, but without one adult male among them. The majority are females, with dark heads and white breasts. A few immature birds can be recognized by their white heads.

Even from the anchorage some of the males can be seen sitting on their nests with red throat-sacs inflated. Others are in the air, but they avoid the ship. The stick nests are mostly on low bushes not far back of the shore; and in two different years I have seen the colony very active, with eggs but no young nestlings, in late March and April. How long their breeding season lasts I cannot say, but this would seem to be its commencement. A few masked boobies make their homes on the ground, while red-footed boobies build most of their nests a little higher in trees. Beautiful forked-tailed gulls *(Creagrus furcatus)* incubate their eggs or tend their chicks on rocks close to the shore. Gray lava gulls *(Larus fuliginosus)* gather on the beach, but seem not to nest here.

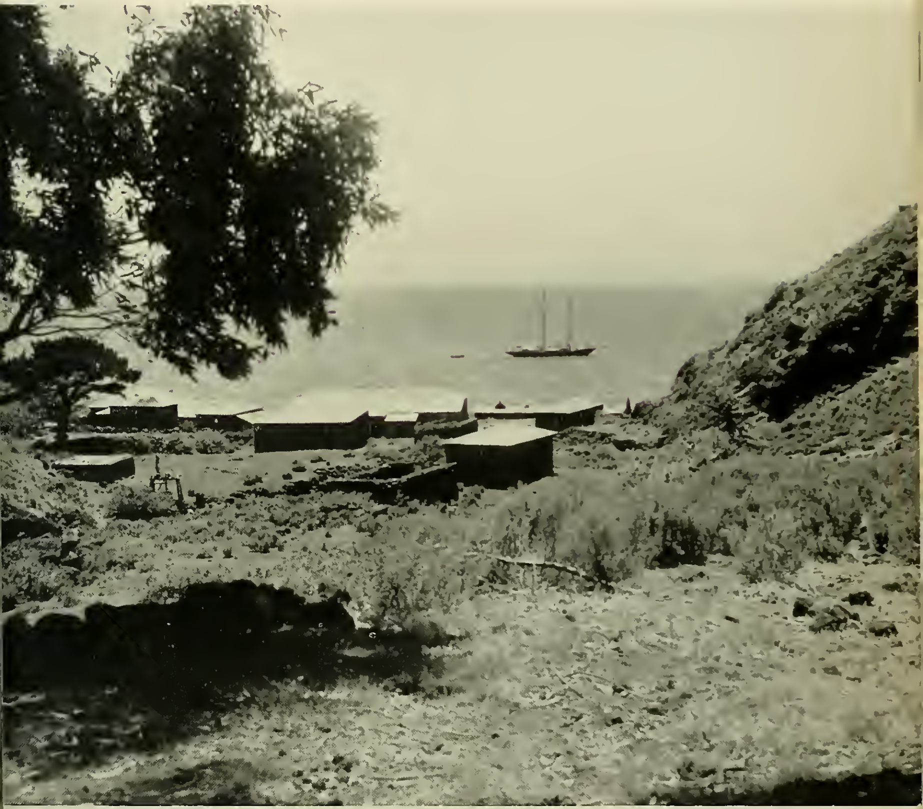
The sun beat down with an ardor that was fully equatorial. We had drunk all the water in our canteens. Yet it was not without regret that I quit this torrid shore for the cool comfort of the "Zaca," wondering whether I should ever pay it a third visit.

Farewell to the Pacific

Five and a half days later we were off the Pearl Islands in the Gulf of Panama; and early the next morning, the first of April, 1935, we docked at Balboa. Old friends waited on the dock: Mrs. Jaques, Doctor Chapman, James Zetek, and Doctor Guillermo Patterson. Patterson and I were school-mates; Doctor Chapman has watched over me almost since my school days. Largely to Zetek we owe the Barro Colorado biological station, where Doctor Chapman soon took me.

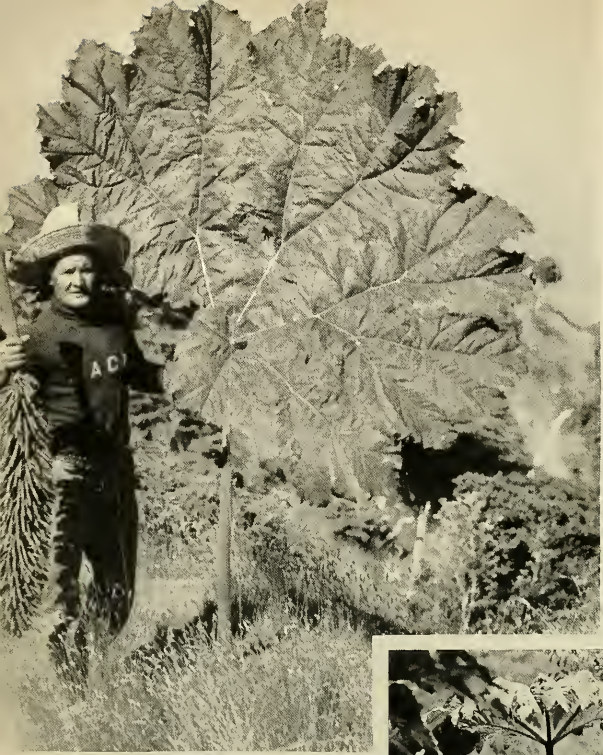
Since I had been signed on as Purser of the "Zaca" I received my Certificate of Discharge at Balboa. The notations concerning my ability and my seamanship I consider altogether too flattering. For six and a half months I had been privileged to watch the ocean, the islands, and the birds. For that I give thanks to Mr. Crocker and the Museum.

Islands West of South America



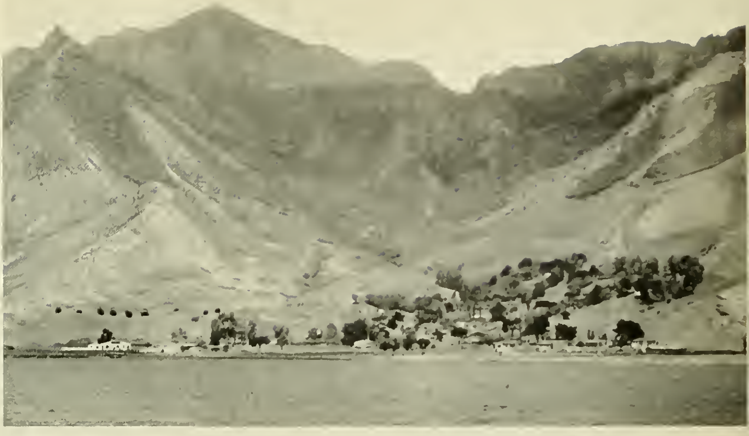
Toshio Asaeda

Except for a few eucalypts and pines there was no shade about the deserted penal colony on Mas Afuera, the outermost island of the Juan Fernández group. Located at the mouth of a great gorge, it needed no prison wall, many miles of ocean serving far more effectually

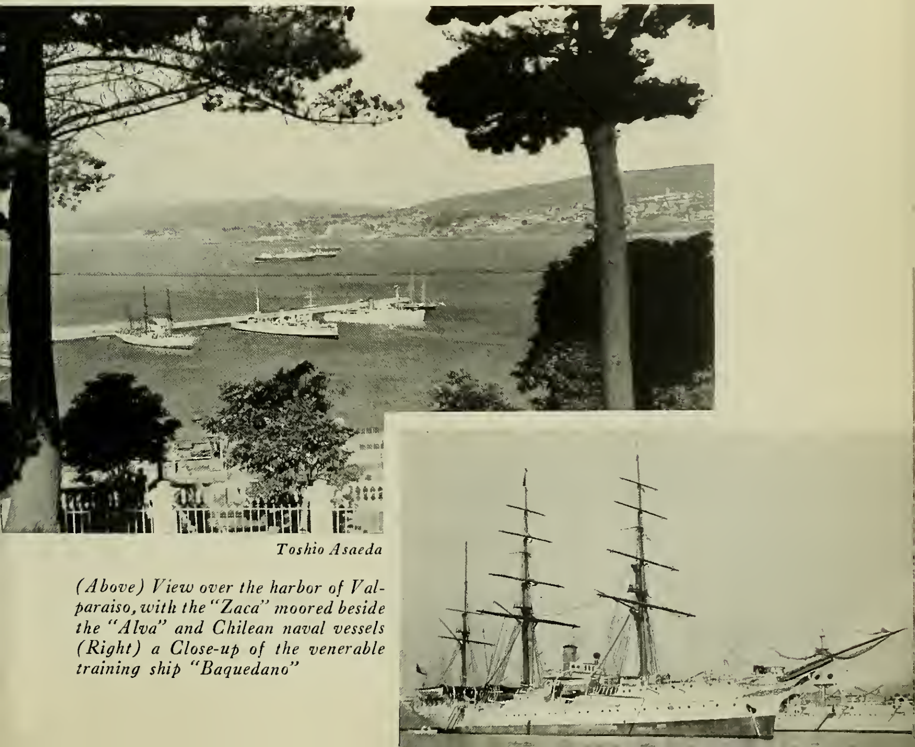


The largest leaf, save those of palms, that I have ever seen. Jack Ratikan, a sailor born north of the Arctic Circle, holds up a Gunnera *leaf and flower-spike*

A Gunnera *plant in the woods on Mas Atierra. Mr. Bock, who stands by its stout trunk, is an enthusiastic collector of plants, and volunteered to guide us on our short visit to this island*



The main village on Mas Atierra, named after St. John the Baptist. The notch in the ridge behind, some 1800 feet above the sea is Selkirk's Lookout, where he could watch for a sail on opposite sides of the island. The middle slopes of the mountains are well wooded, the shore decidedly arid



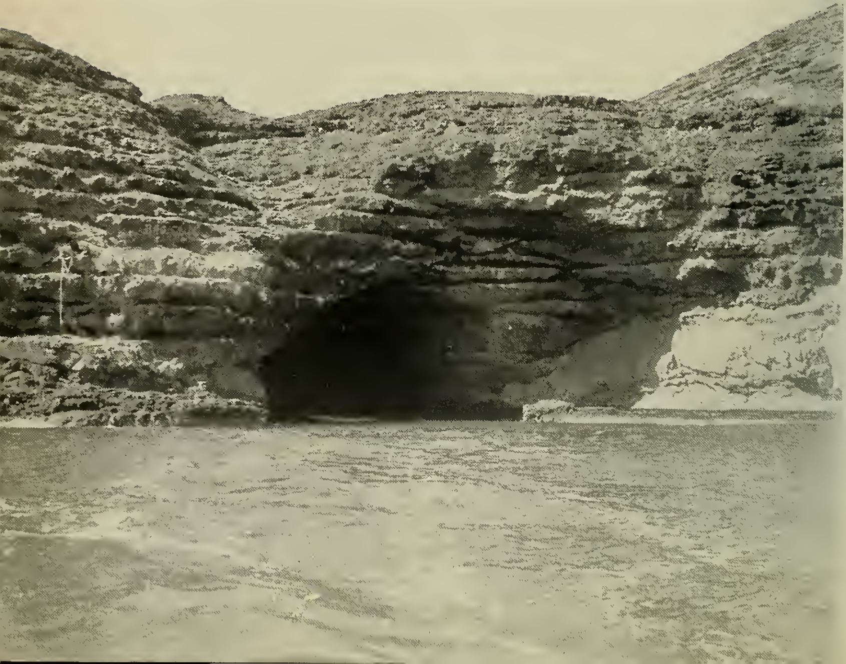
Toshio Asaeda

(Above) View over the harbor of Valparaiso, with the "Zaca" moored beside the "Alva" and Chilean naval vessels (Right) a Close-up of the venerable training ship "Baquedano"

(Above) San Ambrosio Island from the west. Its forbidding cliffs make it a fortress for nesting petrels, and on its summit grow a dozen or more species of plants that illustrate the effect of long isolation from the continent

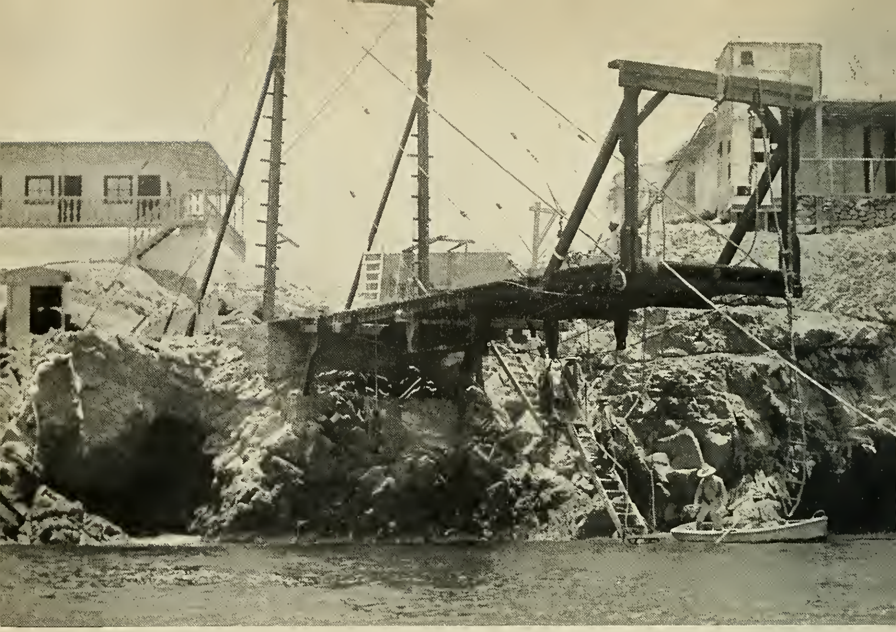
(Below) The only place to land on San Felix, at the left of a deep cave worn by the sea. Successive flows of lava are indicated by the bands in the cliff, which show that originally the island was very much larger

(Photo by Toshio Asaeda)



(Above) View along the barren plateau of San Felix. From these high black cliffs the ground slopes gently in the opposite direction toward the landing place. Gonzales Island in the right background

(Below) A masked booby of San Felix on her nest. Restricted to the warmer oceans, this species is found around the world. The gannets of the colder oceans are near relatives of boobies



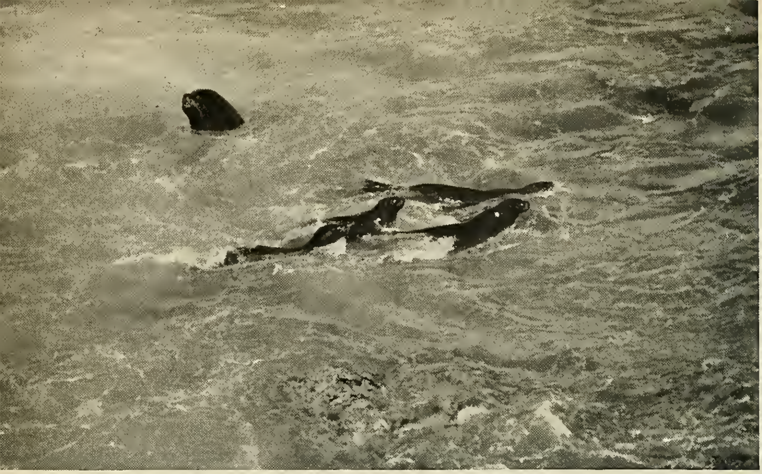
Toshio Asaeda

(Above) The Chincha Islands are well equipped for the loading of guano into ships. Each island has its piers, and here and there are quarters for the guardians and the workers

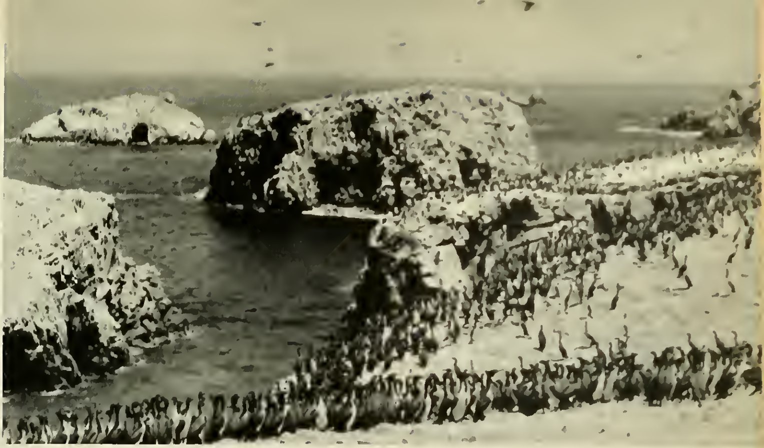
(Below) Those "very strange birds," the pelicans, live on the tops of many cliffs, from which they can readily take wing. The passing of our motor boat, however, rarely disturbed them

(Above) Inca terns feed in flocks low over the water, and rest on steep rocks along shore. At first glance so strikingly different from others of their family, they are perhaps most closely related to the plain-colored noddies

(Below) Two Peruvian bird-protectors on the Chincha Islands, with some of their charges, guanay cormorants, on nests near by. The hollows in the white surface of the island mark the location of myriads of old nests



(Above) An old male sea-lion rears his head from the water, in concern or perhaps out of curiosity after his companions have deserted the shore at our approach. Ungainly they may be on land, but once in the water these sea-going carnivores are marvels of grace and speed



Toshio Asaeda

(Above) This picture may be suggestive of a penguin island, but really shows a colony of strong-flying cormorants. Their numbers were augmented by a new brood of full-grown young

(Below) The genesis of a Chincha Island background. Mr. Jaques makes his initial sketch of the rocky headlands and the distant islands from the site of the future bird-group

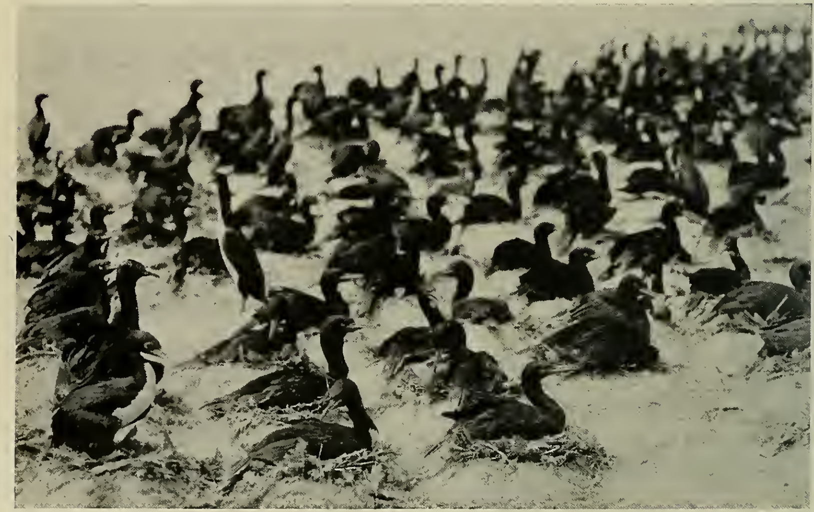
Toshio Asaeda

Mr. Crocker examines the mail at the "P.O. Tagus Cove," on Albemarle Island. The box was first set up in this uninhabited bay by Mr. W. A. Robinson so he could receive mail from home by any fishing boat or yacht

(Continued opposite)

(Below) A peaceful section in a colony of the guanay cormorant. According to Doctor Murphy this is "the most valuable bird in the world" as appraised by the total rent it pays for its ill-smelling tenements

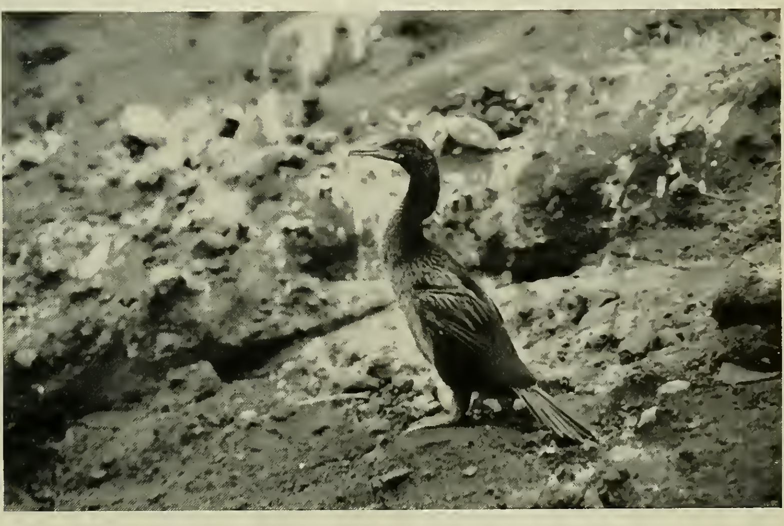
(Photo by Toshio Asaeda)



that came there from Panama, even though he might be away on some short cruise. Here also Mr. Robinson would have died of appendicitis if he had not been able to send a radio from a California tuna-boat

(Photo by Toshio Asaeda)

One of the prominent residents of Tagus Cove, a flightless cormorant. These birds, unknown before 1898, are among those most in need of protection, as they are found only in a small western section of the Galápagos



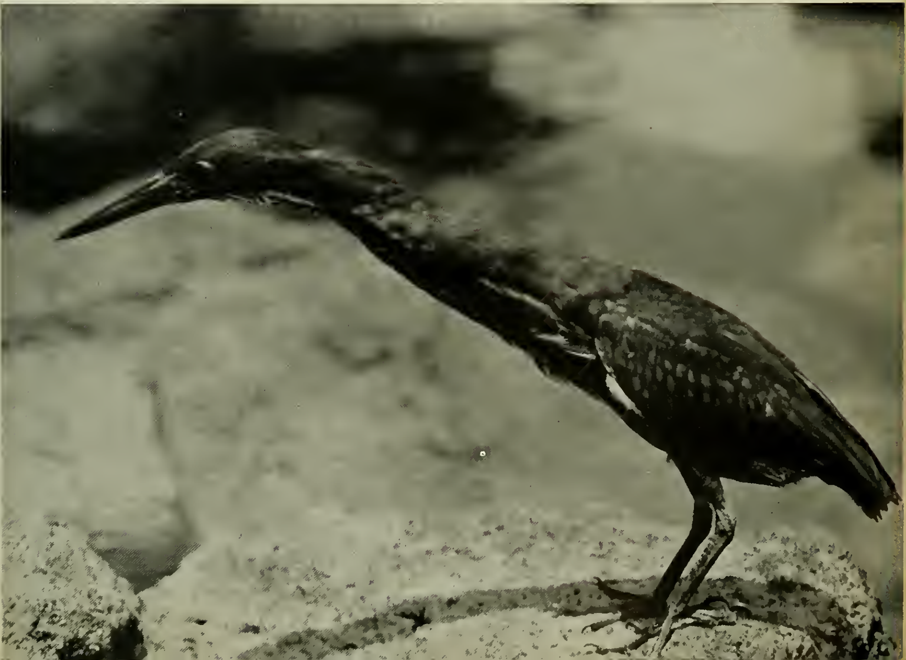
(Above) At Conway Bay on Indefatigable Island Jaques was making a beautiful reproduction in oil of the broad expanse of beach, sea, and islands to be shown in his background. The burning sun made an awning necessary, while the fresh breeze rendered guy-ropes advisable

(Photos all by Toshio Asaeda)

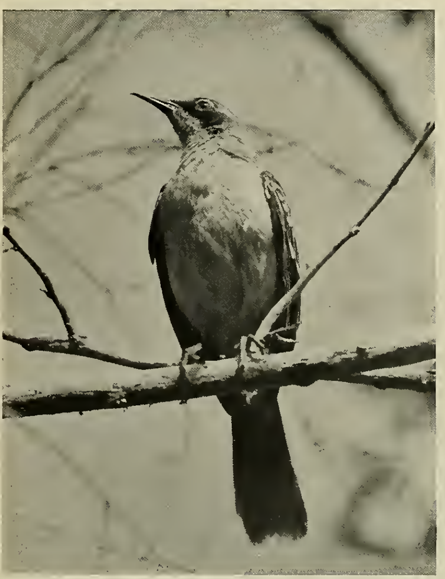
(Left) A great blue heron on the rough lava shore of Conway Bay. It differs very slightly from the North American race of the same species, whereas certain of the other water birds are more markedly divergent from those of the mainland

(Above) One side of Conway Bay, with Eden Island a little off shore. "Eden" it is, perhaps, for marine iguanas and birds. This view is only the left end of the background as planned; to the right many other islands were visible

(Below) A Galápagos green heron that appears to have seen something. When in repose it would draw in its neck so as to appear nearly half this size. This bird is much sootier in color than its relatives on the American mainland



(Above) Mr. Clarence Hay, in 1930, demonstrating how little a Galápagos hawk fears to be taken for a butterfly. Tameness is an outstanding characteristic of many Galápagos birds



(Left) Galápagos mockingbirds are sturdy, venturesome, and inquisitive members of their clan, also less musical than many. There are marked differences between the several forms in various sections of the archipelago, this one being native to Indefatigable

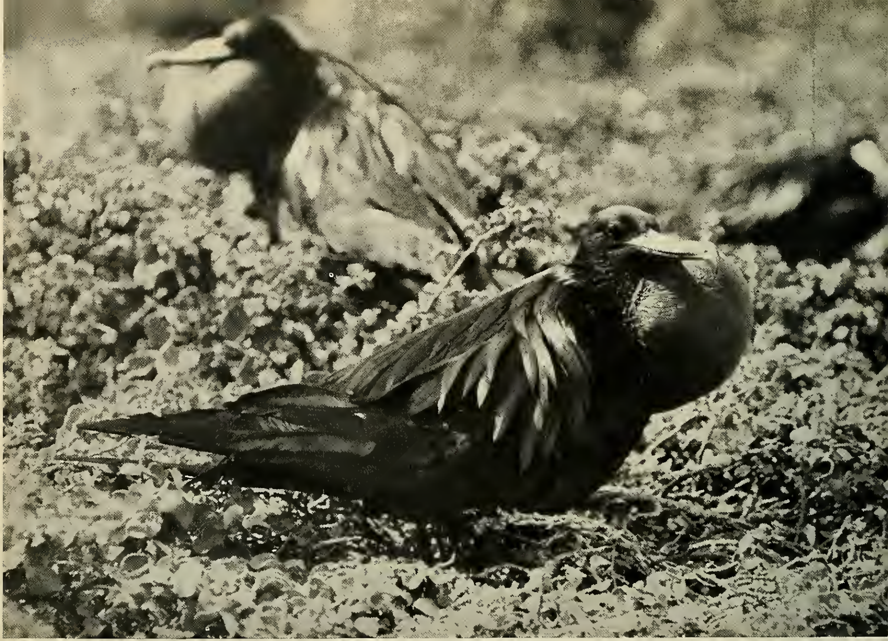
(Photo by Toshio Asaeda)

(Right) One of the brownish Galápagos finches, many of them the females or young of birds that become black in the adult male. In other species even the male may always be brown. To the biologist these are birds of special historical and evolutionary interest

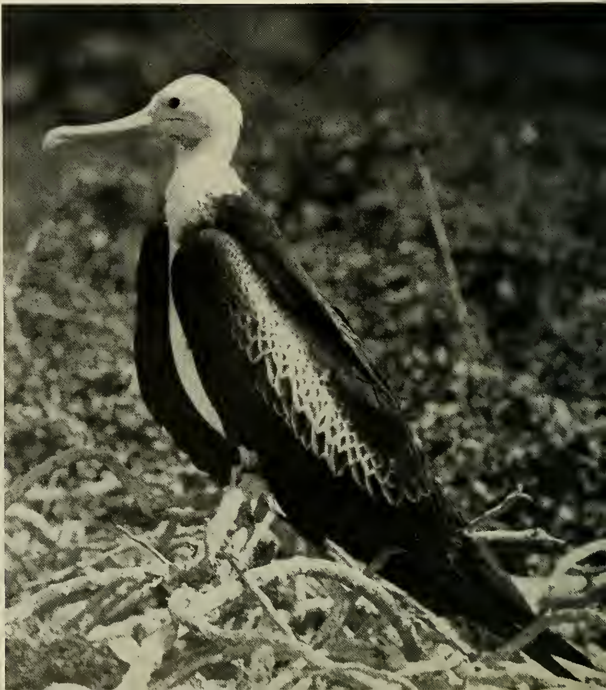
(Photo by Toshio Asaeda)

(Below) A black cactus-finch perched on its favorite food-plant, the Opuntia *cactus. It may be responsible for the sizeable hole below. Its nest is placed amid the spiny pads of the same cactus*

(Photo by Toshio Asaeda)

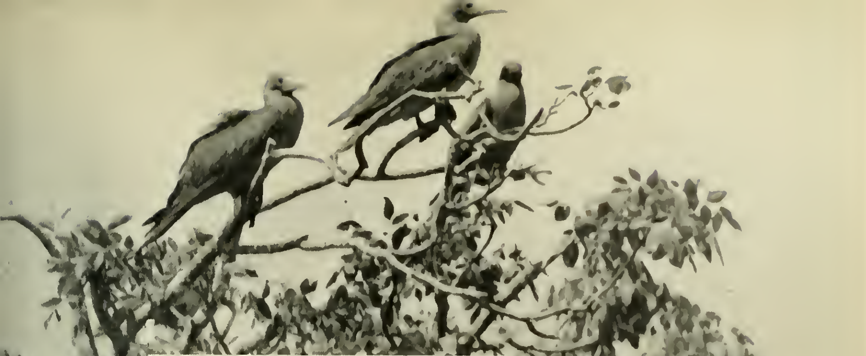


(Above) Looking proud as a rooster, with gleaming hackles on his back, the male frigate-bird seems also to imitate the pouter pigeon



(Right) A young frigate-bird fully capable of flight, still frequenting the old homestead on Tower Island. When it has stolen enough fish from other birds it will mate and start housekeeping too

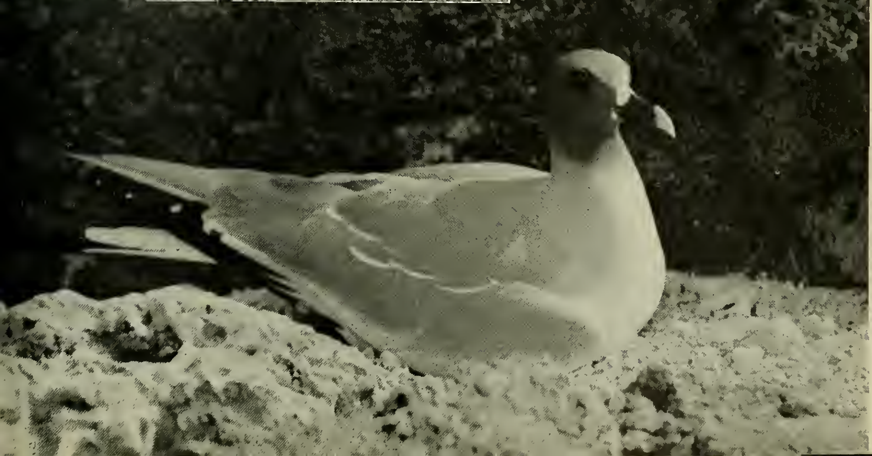
(Photo by Toshio Asaeda)



(Above) The majority of red-footed boobies in the Galápagos remain in a nondescript brown plumage, instead of becoming almost wholly white. They are very fond of perching in trees

(Photo by Toshio Asaeda)

Mr. Toshio Asaeda, photographer, tests the wood of an Opuntia *tree*



Except in its large brown eye, encircled by red skin, the fork-tailed gull when incubating shows little distrust of a human visitor

(Photo by Toshio Asaeda)

Perpetual Ice Under Lava

A natural "ice-box" in New Mexico, where the motorist can find welcome relief from the summer sun and an interesting scientific puzzle to solve

By JOHN STEWART MACCLARY

A LAVA bed whose surface is unpleasantly warm to the touch does not seem a likely setting for a deposit of perpetual ice. Yet in just such a locality, where the brazen New Mexican sun beats down upon a surface which once was molten stone, a deposit of perpetual ice does exist.

Signboards lead the traveler to a volcanic sink, an abrupt depression of an estimated depth of seventy-five feet. This was produced when a natural tunnel in the lava bed caved in. The tunnel was caused by the flowing away of molten lava from the lower part of the bed after the upper surface had cooled and hardened.

The floor of the sink is covered by jagged chunks of grayish black basalt which once formed a roof above the cavity. The accumulated warmth of the air in the depression strikes one almost like the blast from a furnace. One wonders how ice could possibly withstand a temperature such as this.

A hoax?

A skeptical mind prompts the cynical thought: "Just another 'gag' to snare the credulous tourist!" But there is no admission charge, there is no tip-seeking guide, and another sign insists that the Perpetual Ice Cave can be seen at the end of the trail which leads down into and around the volcanic sink. Irregular chunks of fallen stone block what seems to be a cavern in the wall of the sink. As the perspiring visitor approaches this rubble, the air becomes noticeably cooler. Perhaps, after all, the cave of perpetual ice is not a myth.

By this time a feeling of eager expectancy has seized the visitor. He climbs the heap of fallen stone that obstructs the mouth of the cavern. At the summit of the disorderly pile he gazes down into the depths whence comes the current of cool air.

The sight which greets his eyes is well worth the effort he has spent. Imagine a bank of solid ice, mild aquamarine in color, from 12 to 14 feet in height and some 50 feet in width, calmly resting in a tunnel of what once was molten stone—the hottest manifestation of the earth's internal heat!

Feeling is believing

The visitor touches the ice with an experimental finger Yes, it *is* ice—not some illusory mineral crystal. Gone is all skepticism. If the bank of ice can withstand the heat of this August day it must deserve the qualification "perpetual."

The ice is horizontally banded by strange dark lines of stratification. The nearly vertical face of the mass is gracefully curved from left to right. There is very little water from melted ice at the base of the deposit, and what there is registers 32 degrees Fahrenheit. The temperature of the air in the volcanic sink just outside the mouth of the cave is that of a cloudless August noon in the desert of western New Mexico.

The beholder is naturally perplexed as to how the ice was formed and why it does not melt away.

Its presence so near the hot surface of the ground depends primarily upon the fact that lava is among Nature's most efficient temperature insulators. The lava contains an infinite number of minute pores and cavities, and the dead air in them hinders the transmission of heat through the stone from the sun. Once the bulk of a lava deposit has become thoroughly chilled to its depths, heat from the sun cannot penetrate the frigid mass. The cold which produces the ice probably comes from far below the surface. The ice is formed at a point where moisture filtering downward from the surface is met by frigid air from the depths of the insulated volcanic tunnel.

The only warmth which reaches the ice deposit comes from infrequent swirling gusts of air that has been heated in the volcanic sink beyond the obstructing rubble at the mouth of the cavern. The effect of such eddies of warm air is seen in the curving outline of the face of the ice deposit.

The bluish-green tint of the ice is probably produced by pollen wafted onto the ice surface at times when the mass was slowly forming, from pines that grow on the lava outside. The darker bands of stratification were formed by layers of dust similarly deposited. From a distance, or from a photograph, it might be supposed that these bands could be used as reference marks for tracing the age of the deposit as are growth rings in a tree. Actually, the dust bands are not distinct when seen at close range.

Age

It has been said by competent geologists that the lava bed in which this ice deposit is found is of comparatively recent formation. The geologist's interpretation of the term "recent," however, differs from the historian's. On the surface of the lava flow are magnificent yellow pine trees, having trunks more than three feet in diameter. The yellow pine grows slowly in a land where moisture is scant; moreover a fresh bed of lava would not at once offer soil for vegetation. Weathering and the accumulation of dust for a seed bed must have first occurred.

Another bit of evidence of great age lies in the fact that no incident of volcanic eruption has been found in the historical anecdotes of the Indian tribes of the region. And archæologists in the Southwest present evidence that the region has been continuously inhabited for more than a thousand years.

Everything considered, it seems probable that the ice deposit has survived the torrid summers of many centuries in a land whose lack of moisture is almost proverbial.

Deposits of ice in lava beds are not particularly rare. Their occurrence, however, is seldom noted so far south as central New Mexico, (central, that is, from North to South; the deposit is not far from the Western limit of the state). On the map of the United States this spot is almost at the intersection of the parallel 35 degrees north with the meridian 108 degrees west. The elevation is a little more than 7000 feet above sea level.

How to get there

In most known ice beds which occur in lava caves the deposits melt during warm weather. Several ice deposits of continuous existence have been found near the Perpetual Ice Cave, but they are not accessible without the use of horses and resident guides. The Perpetual Ice Cave, may be visited by motorists, by following a secondary road leading southwestward from the town of Grant, New Mexico, on transcontinental highway U. S. 66. The detour moreover takes the traveler to a number of other interesting sites, including the old Spanish town of San Rafael, El Morro National Monument, the old Mormon village of Ramah, and the Indian pueblo of Zuni.

Not far from the mouth of the Perpetual Ice Cave are numerous remains of prehistoric habitations. The ruins consist of low circular walls of lava blocks, presumably primitive foundations. The identity of the builders and inhabitants never has been determined by investigators. It seems probable that proximity to an unfailing source of good drinking water —the ice cave—was justification for settling or camping in a spot where agriculture was not practical.

In this civilized age when "air conditioning" and "automatic refrigeration" have become common terms to most of us, the Perpetual Ice Cave is probably not so mysterious as it was to the primitive Indians who saw it before us.

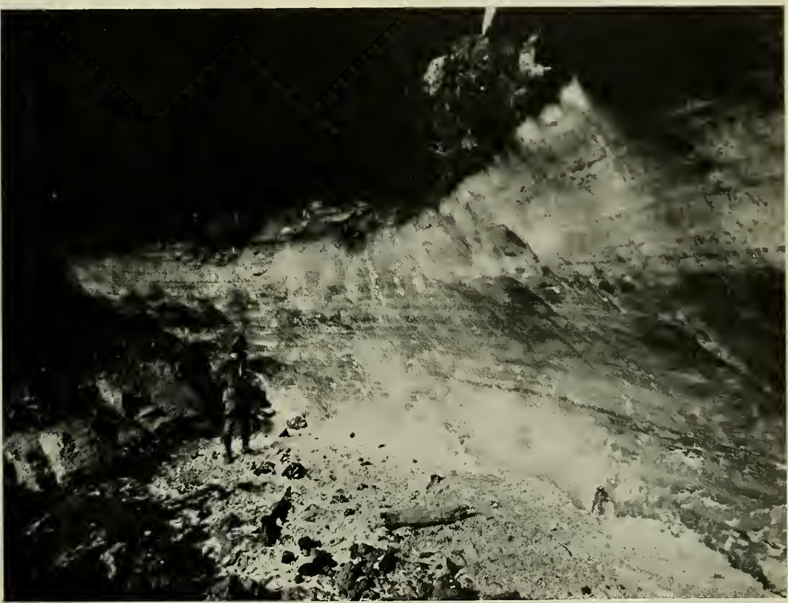
Perpetual Ice Under Lava

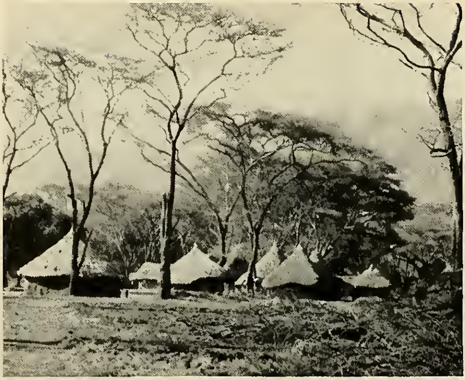
(Left) A bank of solid ice in a tunnel of what once was molten stone: a natural "ice-box" in New Mexico

(Right) The entrance to the chamber containing the ice. The air here on a summer's day is suffocatingly hot

The wall of ice is mild aquamarine in color, from 12 to 14 feet in height, and some 50 feet in width

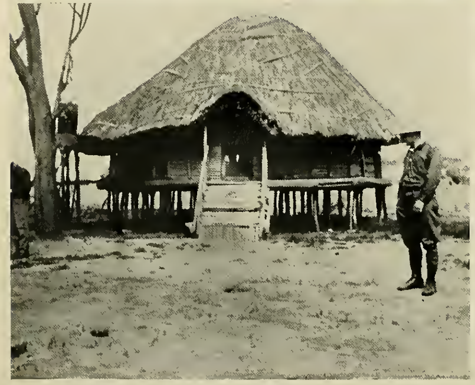
All photos from "Frashers," Pomona, California

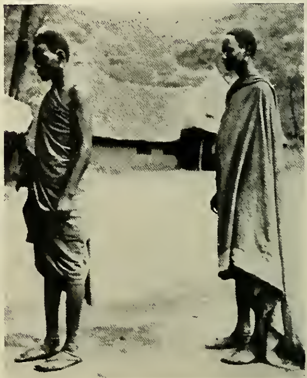




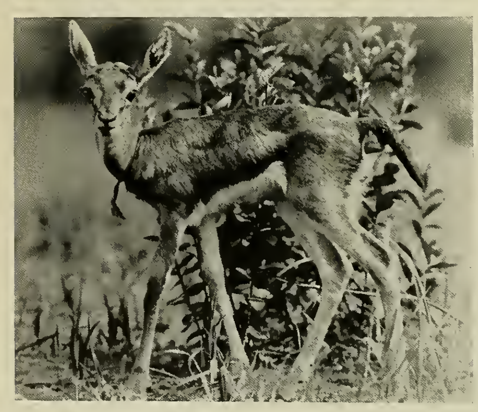
(Left) Maji Moto Camp in Tanganyika Territory at the foot of the Great Rift Wall: the base from which the expedition studied the animals of Africa in the interests of medical science

(Next below) The hut that was used as a laboratory. Native huts rather than tents were used to shelter the expedition. The one shown in this photograph boasted running water supplied by the tank at the left





(Above) Mbulu natives. This tribe lived some four hours' march from camp, on the Rift plateau



(Left) A young female Thomson's gazelle captured on the plain adjacent to Lake Manyara. This animal became very friendly and was a great pet of the expedition

A Safari with a New Objective

An African expedition to search for physiological explanations of temperamental differences in animals and new knowledge on human glandular disorders

By GEORGE CRILE
and
DANIEL P. QUIRING

AN expedition to Africa sponsored by the Cleveland Clinic Foundation and the Cleveland Museum of Natural History was organized in the winter and spring of 1935, the members of the expedition leaving in the fall of that year.

Two members of the group, Dr. and Mrs. George Crile, travelled by airplane from London to Moshi in Tanganyika Territory and at Arusha, joined Mr. Arthur B. Fuller of the Cleveland Museum of Natural History and Dr. Daniel P. Quiring of Western Reserve University, who had travelled by boat from London to Mombasa.

The new objective

In preliminary studies on the size relationships of the brain, thyroid and adrenal gland, made by the Cleveland Clinic Foundation and the Cleveland Museum of Natural History in the United States, a disturbing factor had been encountered which vitiated much of the data. This was the presence of enlarged thyroid glands in many of the domestic animals and in animals secured from zoos. It was imperative, therefore, if the research were to be continued, to carry on the study in animals not afflicted by goiter or by the abnormal conditions imposed by man. This was the task with which the expedition was concerned. The richest territory in the world as far as abundance and variety of animal life are concerned is in Africa in the vicinity of the great crater of Ngorongoro. This area, therefore, seemed to offer us the greatest opportunity for the furtherance of our research.

The selected site was a camp called Maji Moto some ninety miles west of Arusha in Tanganyika territory. This camp lies at the base of the high west escarpment of the Rift Valley about sixty miles from the great crater of Ngorongoro. It was ideal for our purpose since a great deposit of volcanic ash, the tropical sun, the abundant rainfall and the vicinity of Lake Manyara, a great soda lake, produced an abundance of plants and trees and hence of animal life.

Among the great animals

On one side of us was dense bush in which were many rhinoceros and buffalo; on another, swamp and lake in which the hippopotamus makes its home; at the foot of the escarpment was a great mimosa forest in which were herds of elephants and several species of monkeys. Between the forest and lake was a grassy plain on which zebra, impalla, kongoni, wildebeest and other herbivorous animals grazed. Feeding on these herbivora were the carnivora—lion, leopard, hyena and jackal. Various species of smaller cats (serval, genet and civet) found shelter in the forest, and all around and above us, especially in the vicinity of Lake Manyara was a great variety of bird life including vast numbers of European storks and unbelievably large gatherings of flamingoes. Locusts and other insects on the grassy plain gave sustenance to the abundant bird life.

Here we set up our laboratory and established ourselves for almost two months of intensive work. The native type of hut was used for the laboratory and for shelter as well as for the camp. The birds and smaller animals which could be easily transported were dissected in the laboratory, but the larger animals—lion, hippopotamus, rhinoceros, elephant, etc., were dissected where they fell, the various glands and tissues being taken to the laboratory for preservation and packing. Some of the smaller animals were embalmed and sent back to our laboratory at the Cleveland Clinic Foundation to be dissected there.

Many specimens

Representatives of all the true vertebrate classes with the exception of amphibia were obtained. Of a total of 220 animals, 108 dissections involving the eyes, the thyroid gland, the adrenal-autonomic complex, the brain, heart, lungs, liver and kidneys were made in the field. All these organs were weighed and examined before they were packed for shipment, and in addition in a number of animals, gastro-intestinal, muscular and skeletal weights were determined also.

The dissected animals included fishes, turtles, lizards, birds, rodents, carnivora, perissodactyls, artiodactyls, one proboscidian, hyrax, and primates. In addition to these specimens, 118 bird skins were preserved and a chimpanzee, a baboon, two gray monkeys, two vervets and two snakes—a python and a green mamba—were embalmed for dissection in Cleveland. A large amount of skeletal material was saved. In some instances, only the skull and the skin mantles were preserved; in others, the entire skeleton and skin were kept.

Back of the purpose of the expedition already briefly stated, lies the following general thesis:

Man seems to be peculiarly susceptible to certain pathological disturbances affecting the nervous system and the endocrine glands, diseases which are generally unknown in the other vertebrates. The question presents itself therefore as to whether these disturbances might be explained on the basis of possible structural differences between the nervous and endocrine mechanism of man and of the remaining backboned animals, or whether they might simply be caused by man's subjection to a set of conditions to which as yet he has not become biologically adapted. Closely associated with this question a further one arises, namely, if structural differences exist in the endocrine-autonomic mechanism of man as compared with various animals, might this be the cause of the difference in activity patterns of the various animals, since the endocrine-nervous mechanism governs energy expenditure.

With the general acceptance of the theory of evolution, the medical and biological professions generally have stressed relationships between the various vertebrate classes, including man as a member of the primates. But a result of this tendency has been the overlooking or underemphasizing of certain other marked differences between man and his fellow creatures. The anatomist is aware that man possesses a relatively large brain, which expresses itself in superior intelligence, but he is often so fascinated by his study of structure, by the beauty of the story which unfolds itself when he proceeds from the evolutionary point of view, that he too commonly fails to consider man as a distinct problem. He does not generally look upon the organism as a dynamic energy-spending system in which the skeletal-muscular machine requires also an energy-liberating mechanism for its successful self-maintenance. While function is the true province of the physiologist, the necessary restrictions which his special field place upon him may make him generally oblivious to some of the unique characteristics of man or to the organism as a dynamic system whose various functions may be resolved into one great function—the employment and the liberation of energy.

The rôle of the thyroid

The thyroid gland governs the metabolic rate of an animal. In a highly active animal one would expect a correlation between thyroid size and bodily activity. But this is not a simple relationship, as becomes evident when an additional factor is considered, namely, body surface, which determines to a large measure the amount of energy lost as heat. In addition, the thyroid has a definite effect in sensitizing the body to adrenalin, so that the evaluation of the interrelationship of the thyroid and adrenal becomes necessary to an understanding of the true rôle of the thyroid in the body mechanism. Its secretion, thyroxin, is a definite requisite for orderly body growth and normal mental development.

The adrenal glands have been called emergency glands since they supply the energy to meet sudden emergencies. This response is due to the activity of the medulla of the gland,* which secretes adrenalin under stimulation of the sympathetic system. The stimulation originates commonly in the sensory organs, although internal states may initiate its activity. One might expect a relatively large medulla in animals which are confronted with frequent emergencies and which depend upon sudden outbursts of energy for attack or escape.

It seemed desirable to examine this thesis by subjecting a wide range of animals to dissection and evaluation of these particular systems. Since such differences exist, they might well express themselves in relative differences in the weight of the glands or in the degree of complexity of their innervation, i.e., in the autonomic system, or in structural differences. Differences in the potency of secretions in the absence of differences in size or complexity are, of course, not excluded.

A remarkable ratio in man

The earlier studies referred to above had pointed definitely to differences in the relative sizes of the thyroid, adrenal and brain and in the complexity of the autonomic innervation of the adrenals in various animals. For instance, an examination of some 600 animals disclosed that the ratio of the adrenal to the thyroid weights in the rodents ranged from 2:1 to 12:1. In the carnivora, this ratio of adrenal to thyroid weight was 1½:1 to 2:1. In the birds, the ratio of adrenal to thyroid weight was approximately 1.25:1 and in the primates generally the ratio ran from 1½:1 to 6:1. It was only in man that a converse relationship was discovered, for in man alone the thyroid exceeds the adrenal in size. This relative size is expressed by the remarkable ratio of adrenal to thyroid weight of 1:2.4.

A microscopic examination and an evaluation of sections of the adrenal glands of the alligator, the lion and of man showed that in the alligator, medullary tissue makes up about 6.69 per cent of the gland while in the human adrenal the medulla makes up approximately 14.16 per cent, and in the lion the medulla makes up approximately 24.32 per cent of the gland.* Thus, if approximately 24 per cent of the lion's adrenal consists of medulla, the ratio of adrenal medulla to body weight in this animal would be as 1:22,565 in an animal weighing 190.85 Kg. with an adrenal weight of 34.64 grams. In a human being weighing 65 Kg. with an adrenal weight of 10.7 grams, the ratio of adrenal medulla to body weight is 1:54,805. In an alligator of 109 Kg. with adrenal glands weighing 5.8 grams this ratio becomes 1:280,951. While these studies were made on single glands, in each case histologic examinations of adrenal bodies from other lions, human beings and alligators, indicate that the lion generally contains a considerably larger amount of adrenal medullary tissue than does the human and certainly a vastly greater amount than does the alligator.

This, then, is the general outline of the thesis on which our investigation proceeded, together with a few of the provocative findings which made this African expedition such a promising adventure. It is not the purpose of this paper to present a detailed report of our African findings. The data are now in the process of being evaluated and will, it is hoped, be made available in due time.

Tentative conclusions

Sufficient regularity appears in our findings, however, to warrant some tentative conclusions; fuller scrutiny of the material is required to appreciate certain implications in the weight and dissectional data. The specific difference in the thyroid-adrenal ratio and in the thyroid-body ratio which appeared to exist in man as compared with other animals on the basis of our earlier work in the United States, has been confirmed so that it may be stated definitely, we believe, that man stands in a unique position with reference to these relationships. A further tentative conclusion is that the gross size of the adrenal body seems to be a function of the body mass but that the size of the medulla is further governed by the activity pattern of the animal or, conversely, the physical activity pattern of the vertebrate body is determined by the mass of the adrenal medulla. A further fact which stands out is the marked difference in the complexity of the innervation of the adrenal body and the adrenal-autonomic complex in various animals. There is, of course, a definite evolution of the adrenal body and the autonomic system when one passes from the fish and the reptile to the mammals. Within the individual classes of vertebrates, however, marked differences in the degree of development of the gland and of the autonomic system occur.

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* The cortex of the gland serves another function.

* These figures are based on approximations made with a planimeter upon sectioned glands.

We return to the question of whether man's peculiar pathological disturbances are determined by the unique relationships which exist between his thyroid gland and his body. To this one may answer that since this difference does exist between man and other vertebrates and since this gland does play the central rôle in body metabolism, it is reasonable to suppose that its frequent hyperactivity resulting in a variety of pathologic states may be due to its unique size relationship. This view receives additional support when it is considered in relation to man's peculiar biological mode of life and when the inter-play of the adrenal and thyroid glands is considered.

Activity pattern of animals

The further question which is naturally raised by our initial hypothesis is: May we ascribe differences in the activity-pattern of animals to specific differences in the degree of development of the thyroid gland, the adrenal body and the autonomic system? This may be answered affirmatively, we believe, on the basis of the mass of evidence which has accumulated in the past few years on the central rôle of the adrenal and the autonomic system in stepping-up the rate of energy expenditure, as well as on the basis of the body of evidence we are accumulating with reference to the changes in medullary size correlated generally with physical activity.

We cannot omit a word of appreciation for the kind of coöperation given us by his Excellency Sir Harold McMichael, the Governor of Tanganyika Territory and his Staff as well as to Captain P. C. Hallier, Provincial Commissioner with headquarters in Arusha, and Captain P. Teare, Chief Game Warden for the district.

His Excellency, the Governor, granted us special permits which enabled us to secure a number of specimens which are ordinarily protected. On the basis of their extended experiences in the territory, the provincial Commissioner, P. C. Hallier and the Game Warden Captain Teare gave us much valuable information concerning the habits and the location of some of the animals we desired to secure.

We are indebted also to his Excellency P. Enen Mitchell, the Governor of Uganda Protectorate, for his kindness in granting us special permits to secure a pair of chimpanzees in the Protectorate. District Officer James at Massindi in Uganda Protectorate too was most helpful in aiding us in the completion of the necessary arrangements for the safari in the search for chimpanzees. Captain R. Salmon, Game Warden for that area also lent us the benefit of his experiences and if it had not been for these individuals, it is doubtful whether we could have secured our chimpanzees.

Captain J. R. H. Hewlett acted as our professional hunter and guide. Captain Hewlett, who has his headquarters at Moshi in Tanganyika Territory, knows the country and the game animals well. He was indefatigable in his efforts to make our expedition a success. The members of the expedition are unanimous in their feeling that one of the chief factors which made our safari such a pleasant and successful experience were the efforts of this fine personality. It is our unanimous hope that we may meet and work again with Captain Hewlett.

Outposts of Baja California

Desert islands where a vanishing fauna is making a valiant struggle to survive

By JOSEPH R. SLEVIN
Curator of Herpetology,
California Academy of Sciences

OFF the coast of Baja California lie a number of islands and islets harboring a vanishing fauna. The northernmost of these, Los Coronados Islets, are not far from the southern border of the United States. Others are scattered along the shore to the southward as far as Santa Margarita Island, and one group, the Revillagigedo Islands, lie almost 400 miles southwest of the tip of the peninsula.

History

It is from the missionaries that we get much of the early history of these islands. The records show that as early as 1732 Father Taraval, after a wandering journey of some six days from San Ignacio, came upon a great bight in the coastline of Baja California, which he named Bahia San Xavier. From this site he made out two islands six or seven leagues off shore, and with the aid of the Indians Father Taraval constructed a raft on which he reached them.

The nearer one, Natividad, he named Afuega, or Island of Birds, because of the great number of sea birds he found, the only living things he saw on the island. The further island, Cedros, discovered by Francisco Ulloa in 1539, was known as the Island of Fogs. Climbing a high mountain on this island Father Taraval saw to the westward the San Benito Islands, and far to the northward another island, which was undoubtedly Guadalupe.

For the naturalist who is partial to the desert these islands are particularly attractive, their fauna and flora being so characteristic of it. Unfortunately most of those who have been lucky enough to visit them have lacked adequate time for study and exploration.

Although mostly insignificant in size, and with one or two exceptions harboring no spectacular animal life, these islands are a never-ending source of interest to the naturalist. A commercial world, however, which unfortunately knows naught but of dollars and cents and cares nothing for the future, has practically exterminated the fur seal, the sea otter, and the elephant seal. Only strict government protection and supervision can save what is left. The Mexican Government now has laws protecting the fur-bearing animals and the sea elephants, so that there is fortunately some hope of their surviving.

A tale of destruction

For the near, and in some cases complete, extermination of the land birds it is principally the commercial fisherman we have to thank. In order to facilitate their work the fishermen, especially those collecting the abalone, a valuable shell-fish, establish camps ashore, some of which are quite temporary. The custom has been to have a camp cat or two, and when the camp was abandoned these cats were left to run wild. Needless to say, having nobody to feed them, they resorted to hunting for their food, the small land birds being the first to go. Mr. A. W. Anthony, well-known ornithologist of the Pacific Coast, who became acquainted with the islands in 1887, found that on the San Benito Islands McGregor's house finch (*Carpodecus mcgregori*) had become almost extinct in a period of twenty-five years.

Guadalupe Island has been called a biological sepulcher and is a shining example of what can happen when domestic animals are introduced and allowed to run wild. Formerly the home of numerous small land birds and described as a paradise by Edward Palmer, the first naturalist to visit it, the island now harbors only a remnant of what there used to be. The flicker, towhee, kinglet, crossbill, and Guadalupe wren have already been exterminated not to mention the Guadalupe caracara. The goat herders can rightfully be charged with the extermination of the latter bird. Claiming that it attacked the young kids, the herders methodically shot the birds as they gathered about the water holes; and it was not long before the Guadalupe caracara went the way of the great auk and the passenger pigeon. The Guadalupe petrel fell an early victim to the cats. The animals had only to wait at the mouth of a burrow for the bird to emerge bound for its feeding grounds on the high seas. Thus it was that this one-time paradise came to an end.

It is reported that many years ago a whaler, following a common custom of the early mariners, left some goats on Guadalupe Island in order to enable subsequent visitors to obtain fresh meat. While in some cases this may have been the means of saving shipwrecked sailors, it led to the destruction of the foliage, and it might be said in some cases to the island itself.

Death to vegetation

On Guadalupe the goats increased to such an extent that by about 1887 concessionaires were shipping to the mainland some 15,000 goat skins a year. They and many others later, found it to be unprofitable, however, and the goats ran unmolested, occasional droughts being their worst enemy. They have exterminated many species of plants, and only those which grow on sheer precipices will survive for any length of time. The scant forests of oaks, pines and cypress, on the tops of the northern ridges, must in time disappear. Natural causes, such as old age, storms, etc., will account for the disappearance of some of the trees but the goats in the end will take care of the rest. Even now they have the bark chewed off wherever it is within reach. No seedling is allowed to survive, and no acorn will ever mature. Thus the disappearance of the Guadalupe forests is inevitable.

About the year 1880 the Guadalupe fur seal (*Arctocephalus townsendi*) was exterminated as far as commercial hunting was concerned and for years afterwards the animals were considered extinct. It therefore created considerable excitement among naturalists when, in 1928, two fur seals were brought from Guadalupe to San Diego by some local fishermen. It is evident that a small remnant of the herd had escaped the slaughter and had hidden away in inaccessible caves unknown to the sealers and poachers.

About the south end of the island may still be seen the remains of stone huts built by the sealers, and driveways up which the animals were driven to the slaughtering ground. The rocks that were polished by countless numbers of seals passing over them in bygone ages are distinguishable, and even the pegs driven into the ground to set taut the skins for drying are still in evidence, mute reminders of the hardy adventurers of early days.

Home of the sea elephant

By far the most spectacular animal of the Baja California outposts is the sea elephant, or elephant seal, as it is sometimes called, a huge animal weighing several tons and reaching a length of twenty-two feet. These animals fell before the onslaught of the whalers who prized them highly for the oil obtained, and like the fur seal they were hunted until the exploitation was no longer profitable. These creatures fared somewhat better than the fur seal, however, and today there is a fair-sized herd (some 500 or more animals) making their home on a sand beach at the northwest end of Guadalupe Island, where they are protected by towering cliffs which make it impossible to reach them from the land side. As this shore has the whole Pacific Ocean to beat on it, it is only on the finest and calmest days that a landing can be made. This, coupled with the fact that the Mexican Government has passed stringent laws protecting the herd, may enable it to increase in years to come, so that it may once again reach its former state.

Cedros Island, one of the largest of the coastal islands, is nearly 21 miles in length and rises to a height of 3959 feet at the northern end. It is rapidly sharing the fate of Guadalupe. The abalone fishermen have found it a fertile fishing ground and have established a camp at the southern end as their headquarters. To furnish fuel for boiling the abalones before drying them they have stripped the nearby canyons of vegetation and in their boats have gone farther afield, touching all the canyons along the eastern shore, and cutting out all the small trees. Where there were once picturesque little canyons spotted with juniper trees, which gave shelter to the native deer, there is nothing left but desolate rocky dry washes, where even a horned toad would have difficulty in finding a shady spot to escape the heat of the noonday sun.

Slaughter of deer

Serious inroads have been made on the deer to furnish meat for the abalone camp. The few that have escaped the slaughter hide out on the steep slopes of the northwest end, where a scattering of brush and trees furnishes a meager shelter. Owing to the fact that it is a long hard pull back to camp the few remaining animals may be saved for the time being; but it may be only a question of a comparatively short time before their doom is sealed.

Bird life is somewhat scarce on Cedros. Say's flycatcher, large-billed sparrow, desert sparrow, Costa's hummingbird and a few other species are represented. All visiting ornithologists have remarked about the scarcity and wildness of the small land birds on this barren and windswept island.

Leaving the coast islands and heading southwestward from Cabo San Lucas, the southernmost point of Baja California, we find two interesting islands, Socorro and Clarion, of the Revillagigedos. Socorro, the largest of the group, is a mountain peak rising out of the sea to an elevation of 3500 feet and visible at a distance of seventy miles. Its inhospitable shores must be approached with care as anchorages are poor and the winds at times strong and uncertain. The lower levels of the island are densely overgrown with brush, making traveling an arduous task. A casual observation from the deck of a vessel gives the traveler no idea what he must encounter before reaching the summit. Socorro shows signs of volcanic activity, and just below the summit are blowholes from which steam escapes in small clouds, and hot mud flows from miniature craters.

Fortunately Socorro has not been used for fishing camps and a most interesting bird population remains there; but now that commercial fishermen are going far afield for their fishing grounds it will only be a question of time before it meets the fate of all the coastal islands. The usual shore birds, such as the yellow-crowned night heron and the wandering tattler may be found commonly about the rocky beaches, but to see the bird life in all its variety one must climb the mountainside beyond the rank growth of brush. There the traveler emerges into a tree belt that any ornithologist would give worlds to visit. Here may be found large flocks of the beautiful Socorro paraquet feeding on the fruits of the native trees, or equally large flocks of the Socorro mourning dove, fearless at the approach of man as it walks about the ground. The Socorro red-tailed hawk may be seen soaring overhead as it searches for its prey. In short, pencil and notebook must constantly be in use in this ornithologist's paradise.

A bird of the lower levels is the Socorro elf owl *(Micropallas graysoni),* which as its name suggests is a pigmy among owls. It bears the name *graysoni* after Colonel Andrew J. Grayson, who, in the year 1867, made a private expedition to the Revillagigedo Islands and lost his vessel on the south coast of Socorro at a spot now known as Grayson's Cove, a small indentation in the coastline of Cornwallis Bay. In 1925 some of the dried out planks of his vessel, then worn almost to the thinness of shingles, were found on the rocky beach by the Expedition of the California Academy of Sciences to the Revillagigedo Islands on board the *USS Ortolan,* M. M. Nelson, Lieutenant, U. S. Navy, Commanding.

A life-saving spring

On reaching shore from the wreck Colonel Grayson's first thought was of water, the lack of which is the dread of every mariner unfortunate enough to be shipwrecked on these inhospitable shores. By good fortune a member of his crew discovered a small stream of water gushing out of a seam in the rocky cliffs. It is partly concealed by a pile of boulders, and covered by the sea at high tide, thus making it very difficult to find. It would no doubt have been taken for tide water were it not for the fact that the birds were seen drinking from it. This spring would be the only salvation for the shipwrecked mariner, at least in the dry season, and it is so well concealed that since Grayson's discovery it had escaped detection until the Academy's expedition of 1925. Before leaving on this expedition Colonel Grayson's account of his trip was consulted, and the spring was found just as he had described it. This all-important discovery was made known to the United States Hydrographic Office, so that future Coast Pilots, or supplements, may contain this information. In order to facilitate locating the spring a large W, filled with white cement, was carved in the rock, with an arrow pointing to the water and an inscription.

Fortunately for Colonel Grayson he "picked" a particularly nice place to be wrecked, for aside from having the spring at hand, the back of the beach was covered with a thick growth of trees, giving both shade and firewood. If he had tried all the beaches on the island he could not have found a better one. The adjacent waters abound in fish and there are plenty of sheep, in a half-wild state, scattered over the island from the seashore clear to the summit.

The original stock is said to have been placed on the island, in 1869, by John Smith, who obtained authority from the Mexican Government to make use of it as a commercial venture. He also introduced some twenty-five head of cattle, but most of these died and the remainder were killed for meat. The sheep fared better and multiplied considerably, notwithstanding the intense heat and the rough character of the country.

Isolated island fares better

Less visited than Socorro on account of its isolated position some two hundred and fourteen miles to the westward is Clarion Island. Although much smaller than Socorro it is interesting because it is seldom visited and the fauna and flora still remain in their natural state. The tameness of the birds reminds one of the far-off Galápagos. The little ground owls can be approached and chucked under the chin without their showing the slightest fear.

Great numbers of sea birds make Clarion a nesting site, and boobies, frigate birds, tropic birds, and the usual shore birds, such as curlew plovers, turnstones and great blue herons, are found along the coastline. One striking feature of the fauna of the island is a large reddish-brown snake *(Coluber anthonyi)* resembling the red racer of our southern deserts. They are found abundantly about the *Opuntia* patches, and it may be safe to say that Clarion Island is one place where you can go ashore and be sure of finding plenty of snakes. How they reached the island is a problem yet to be solved. It is a significant fact, however, that no snakes have ever been found on the neighboring island of Socorro, much nearer to the mainland.

Every visitor to Clarion remarks about the wonderful growth of cactus covering the southern slopes of the island. A great carpet of *Opuntia* spreads over the landscape and it is only in the thinner areas that it is possible to get through, and then only with the aid of a machete. To make things more interesting the top of the cactus growth is covered in many places with a carpet of morning-glory vines, forming an impenetrable tangle. The northern slopes of the island offer quite a different aspect, being fairly open and covered here and there with patches of long grass. In these nest thousands of Townsend's shearwaters *(Puffinus auricularis)*, their burrows honeycombing the hillside so that in certain areas walking is somewhat of a problem.

Wild life demands protection

Now that fishing vessels go great distances out to sea in quest of the deep sea fishes it may only be a question of time before Clarion meets the fate of the coastal islands. Only its poor anchorage and the lack of suitable landing places may help to postpone the destruction of this interesting fauna. Sulphur Bay, the only anchorage, is an open roadstead and affords poor shelter, being exposed to all southerly winds. The landing place, in a small cove to the westward, is dangerous even in calm weather on account of the unexpected swells that roll in from an apparently calm sea, and a vessel may anchor for days, or even weeks, without being able to put a landing party ashore.

If the Government of Mexico can enforce the laws protecting the wild life of these islands there may be some hope of saving the fur seal and the sea elephant from extinction; but the land birds will have a difficult time to survive. The disappearance of the wild life of any land is regrettable, and it is slowly but surely happening here.

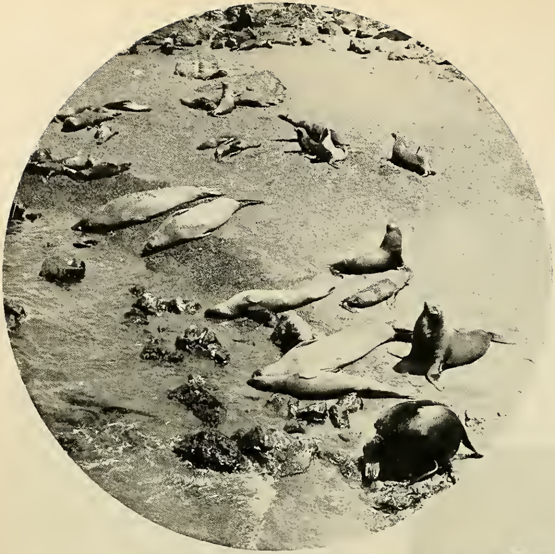
Outposts of Baja California

(Above) A scene on barren, windswept Cedros Island, one of the "outposts" off the coast of Mexico. At the top of the ridge can be seen a straggling pine forest, while below it is a scattering of dwarf juniper trees

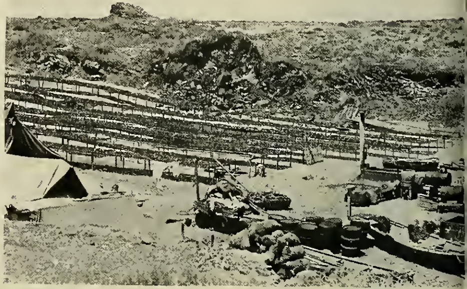
Photos by G. Dallas Hanna,
California Academy of Sciences

The above photograph shows a grotesque elephant tree which stands as a sentinel on a rocky promontory of Cedros. The beautiful pink flowers of these trees when in bloom lend almost the only touch of color to the island

(Right) Frigate birds are abundant on many of Baja California's outposts and San Benedicto Island is no exception. The inflated crimson pouches of the males on the nests make the ground appear as though covered with a great red blanket



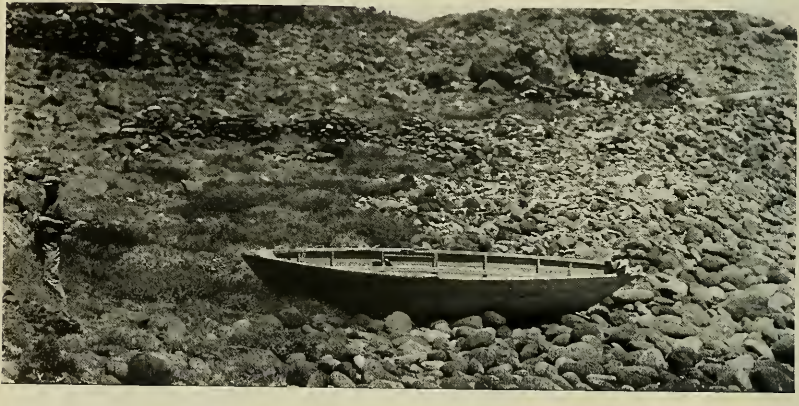
A herd of sea lions on the San Benito Islands. Formerly the sea elephant, sea otter, and fur seal made these three small rocky islands their home, but the fur bearers are gone and all that remain are the sea lions and occasionally a few visiting sea elephants from the Guadalupe herd (Photo by W. Chas. Swett, Courtesy of the G. Allan Hancock Expeditions)

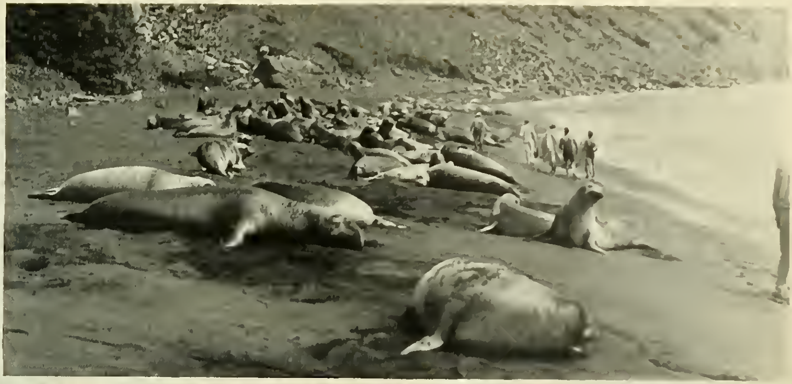


(Right) Drying abalones on West San Benito Island. The use of diving suits by the Japanese fishermen and the indiscriminate gathering of the abalone, regardless of size, will in time result in its destruction

Photos by G. Dallas Hanna, California Academy of Sciences

(Below) Where the sealers once carried on their trade: at Melpomene Cove, Guadalupe Island. The derelict dory shown in this picture might tell a story if it could speak, but nothing was found to indicate from where it had come



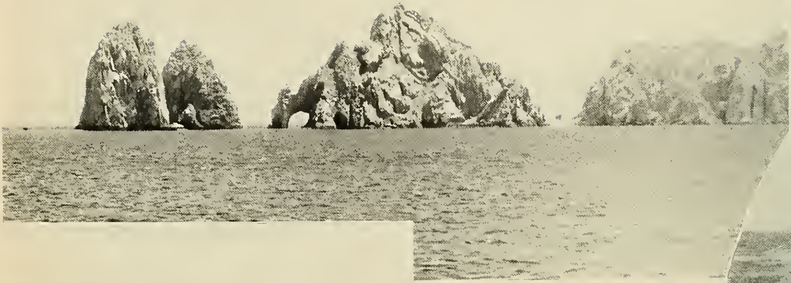


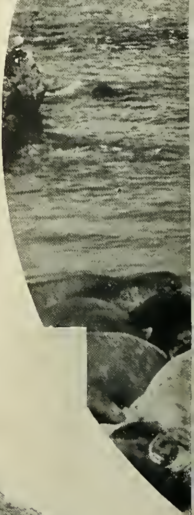
It is possible to walk amongst the sea elephants at Guadalupe Island without disturbing them in the least—after you have landed. But natural obstacles make this beach well-nigh inaccessible (Photo by W. Chas. Swett, Courtesy of G. Allan Hancock Expeditions)

(Left) The sea elephant knows how to relax, and although this one may appear lifeless, such is by no means the case

Photo by G. Dallas Hanna,
California Academy of Sciences

(Right) The head of a basking sea elephant: not a thing of beauty but a curious looking creature to say the least (Photo by W. Chas. Swett, Courtesy of G. Allan Hancock Expeditions)





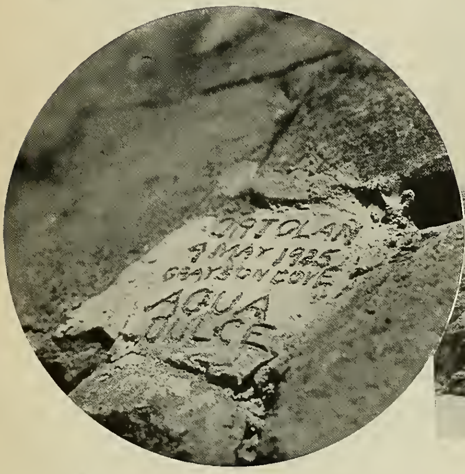
(Above) Cabo San Lucas, at the southern tip of Baja California, is a famous headland and a useful landmark for all passing vessels

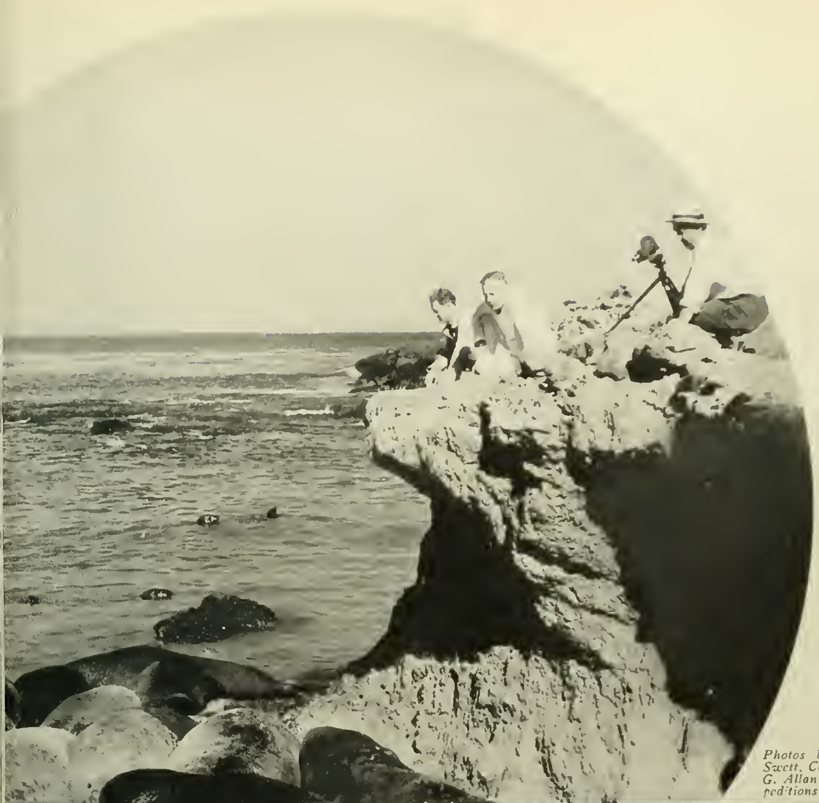
(Left) Grayson's Cove on Clarion Island where a spring of fresh water saved the lives of Colonel Grayson and his crew when shipwrecked a half century ago

Photos by G. Dallas Hanna, California Academy of Sciences

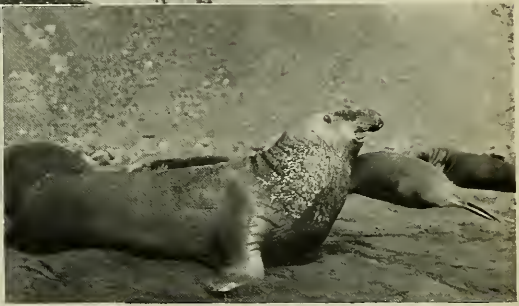
(Below) The cement plaque left by the U.S.S. Ortolan *to direct mariners in emergency to the spring*

(Lower right) Monument Rock, one of the prominent landmarks off the coast of Clarion Island





Photos by W. Chas. Swett. Courtesy of the G. Allan Hancock Expeditions



(Above) Sea elephants under observation on the beach of San Benito Islands. The sea elephant is the most spectacular animal of these outpost islands. The Mexican Government's stringent laws may enable it to increase to its former abundance

(Above) A large bull sea elephant poses for his portrait. These creatures weigh several tons and reach a length of twenty-two feet

Two Scenes at Fallodon

(Above) The larger of the two ponds on the estate of the late Lord Grey, where over twenty species of wild ducks make their home.

In the lower picture Lord Grey is seen seated at the side of this pond feeding an American canvasback, one of a brood of birds hatched at the pond-side, which after an absence of seventeen months returned and fed from his hand the day of its arrival. From this side one looks across the pond to Fallodon as shown in the upper picture.

These two photographs are reproduced from an article by Lord Grey in the September-October, 1932, issue of NATURAL HISTORY

Memorials to Lord Grey

Plans to perpetuate the ideals of a man who strove for international harmony and a broader appreciation of Nature

The General Committee of 69 formed in England to create a memorial to the late Viscount Grey of Fallodon has issued an appeal for support which, in a few words, admirably states its objects. It reads:

"Lord Grey is remembered as the statesman who fought so long and so hard the losing battle for European peace; and who, amid the blinding passions of war, with failing health and eyesight, never lost his mental vision of two main principles of his practical idealism, the necessity of friendship between the British Empire and the United States, and the necessity of some collective security for future peace, which from the first he strove to see embodied in a League of Nations.

"He is remembered also as the lover of nature. In writings that combine the poetry and the science of bird observation, he has taught many to find the purest and most lasting joys of mind and heart.

In public and private life

"Yet the two aspects of his life are not to be dissociated. If the strength, integrity and simplicity of his character made him for eleven years the notable representative of his country before the world as Foreign Secretary, and helped to give to the British Empire and her Allies confidence and unity at the supreme crisis of fate, these qualities were drawn from the same well-springs of old English rural life which inspired him as a countryman, a naturalist and an author.

"We therefore propose to erect to his memory a threefold memorial:

"1. To set up a statue or bust in a central spot in London.

"2. To acquire and make over to the National Trust 'Ross Castle', the small hill-top crowned by an ancient earthwork which adjoins Chillingham Park in Northumberland, a favourite view-point of Lord Grey's which he often visited from Fallodon.

"3. To develop (by further endowment and otherwise) the existing scheme of research maintained by the British Trust for Ornithology at Oxford, of which University he was an undergraduate and in later years the Chancellor, to form a permanent Institute of Bird Studies, to which his name would be attached."*

The bond among nature-lovers

It is the last-named object that will most strongly appeal to those who will welcome an opportunity to pay their tribute to the memory of Lord Grey. Busts and "National Trusts" have their places, but this plan to form a living memorial which, we may assume, would not only increase our knowledge of birds but would aid in promoting that relation between birds and man, the value of which was so eloquently demonstrated by Lord Grey himself, transcends in its importance all national bounds and concerns nature-lovers throughout the world. We can readily imagine bird students of other nations seeking instruction at Oxford, and as the success of the "Edward Grey Institute of Bird Studies" becomes apparent, who can doubt that similar Institutes will become a part of other centers of learning? Here is the foundation of a League of Nations which might assure at least a bird protection under whatever flag it happened to find itself.

It may also be assumed that among the textbooks used by this proposed Institute a high place would be accorded Lord Grey's "Charm of Birds." While this work is dedicated chiefly to English passerine birds, their appearance and personalities, their place in nature and in literature, their association with the seasons, and especially their voices, it also records, with convincing enjoyment and wholesome sentiment, the value of birds as an expression of their environment.

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* Subscriptions to the memorial fund payable to J. P. Morgan & Company, may be sent to that firm at 23 Wall Street, New York City, who will remit them to the Barclay Bank, agents of the Memorial Committee in London.

Read, for example, what the "robust, buoyant" song of the chaffinch meant to its author. "If the chaffinch were human," he writes, "one can imagine that he would say 'Cheerio!' as a greeting to a friend. . . . One chaffinch stands out in my memory as does a single dipper and a single wren. It was in the Whitsuntide recess, when for a few precious days late in May or early in June I had escaped from Parliament and from London, whose 'season' is then so miserably unseasonable. The days were fine and bright. On a stone coping of a little parapet, that went around the roof at Fallodon, at a corner that faced due south, a chaffinch used to take its stand, and from that eminence pelted me with song whenever I went on the lawn outside. This one bird became a feature of the holiday, an embodiment of happiness proclaimed from the housetop. . . . For me the immortal spirit of those happy Whitsuntide days still lingers in the song of the chaffinch."

The whole book abounds in similar responses to the song and personality of birds. I quote once more to show how varied and far-reaching was their influence in Lord Grey's life. Wild ducks were the distinctive birds at Fallodon. Lord Grey had introduced over twenty species and from one to two hundred unpinioned birds were free to go and come. After describing graphically the early morning play of a group of these birds on the larger of his two ponds, as seen from a bench at the pond-side, he writes:

"All was quiet; there was no sound or stir; the water was again smooth, the reflections in it were composed once more; the sun still shone; on the water and the birds; on the scarlet-barked willows and the delicate bareness of winter trees on the opposite side. Anyone who had come upon it now might have thought that the place was under some spell. He would have seen the man on the seat sit motionless, too, for a long time; entranced rather than asleep; the scene had indeed sunk down into his heart and 'held it like a dream.' There are times when man's consciousness seems laid to rest in some great whole, of which he has become a part. There are hours of which it can be said, 'Thought was not: in enjoyment it expired.' So it was now, and if anything stirred in the mind at all, it was an echo of the words, 'And God saw that it was good.'"

FRANK M. CHAPMAN,
Curator of Birds, American Museum of Natural History

A scene from the Roosevelt-Grey Walk in the New Forest in Southern England, reproduced in the American Museum habitat group, which is dedicated to the memory of Viscount Grey of Fallodon

Diving Spiders

Intimate observations on a spider of India which submerges when frightened or in search of food, and preys upon fishes

By GOPAL CHANDRA BHATTACHARYA

Bose Research Institute, Calcutta

FAMILIAR with the rapid manner in which spiders move on land and with their web-spinning maneuvers in the air, many people do not realize that certain varieties have also attained astonishing mastery in the realm of water. To see them leap here and there on the surface of a river or lake is in itself a surprising sight, but most fascinating of all, perhaps, is their habit of submerging and remaining under water for considerable periods. Some are able even to prey upon small fishes.

A spider of this sort is *Lycosa annandalai,* whose activities it has been my fortune to observe in the neighborhood of Calcutta. I came across the specimens I am about to describe quite unexpectedly.

Searching for stick-spiders

I was strolling through the suburbs of Calcutta in the month of March when I came upon a stagnant pool. Though the center was quite clear of weeds, its shores were completely overgrown with aquatic plants and grasses of various kinds. Around the edges the big green leaves of the Colocasia drooped over the surface of the water. These plants were the abode of another variety of spiders, the red-brown and spotted black stick-spiders of the genus *Tetragnatha.*

These spiders, with the purpose of preying upon various minute insects that hover or walk upon the surface of the water, attach themselves to the leaves, stems, or stalks of the Colocasia, where they may easily be mistaken for dead sticks.

I was trying, in vain, to capture some of these interesting creatures when my attention was drawn to a well developed stick-spider, which was passing from one plant to another. As the water was only knee-deep, I tried to catch it, but as I reached out, the spider, detecting danger, leaped with great alacrity upon the surface of the water. Immediately a big gray spider, with spotted back, came running from an adjacent leaf of Nymphoides (*Limnanthemum nymphoides*) and jumped upon the poor creature in the twinkling of an eye. The victim struggled, only to expire within a minute and a half. The aggressor then dragged the dead animal to a blade of grass and began feeding on it.

A chase

I resolved to capture the creature that had made the attack. But as I approached, it jumped and ran away; and I eventually lost sight of it entirely among the grasses that stood out of the water. I splashed the water and disturbed the vegetation sufficiently to cause several others of different sizes and shapes to come out on the surface of the water. Greatly alarmed, they began to run hither and thither.

I singled out another specimen and pursued it relentlessly. Soon the creature became tired and ran no more, but folded all its legs and crumpled itself into a mere mass, resembling something dead. This black mass was floating in an inverted position on the water by the side of some Nymphoid leaves. The instant I placed my fingers on it to pick it up, to my utter surprise it disappeared suddenly and completely, where, I could not follow. I had been quite close upon the creature, but I could not detect the secret of its escape.

For perhaps a quarter of an hour I searched in vain. Thoroughly disappointed, I was about to give up the chase when suddenly just to my right, I saw a big spider emerge from beneath the water. The mystery of their hiding themselves so quickly was then solved. This large specimen with grayish-black back and bluish-white lines around the cephalothorax, had been lurking below the surface. I had had no idea that these spiders could dive under water, like otters and beavers. Since discovering this, I have scarcely ever failed in capturing them.

When frightened, they suddenly submerge and remain clinging to the aquatic plants; and I have often seen them stay below for more than twenty minutes. Because of an air film surrounding their bodies, they look silvery white under water. The coating of air prevents the water from moistening them. The mother spider, carrying a cocoon from which young will eventually emerge, dives under water in a similar manner and under similar circumstances.

The depth to which the spider dives is usually several inches, and if pursued, it creeps for a considerable distance under water along the aquatic plants and tries to hide itself in a place of safety. When exhausted and unsuccessful at concealing itself, it feigns death, folding all its legs and floating on the surface of the water in an inverted position.

In some respects, both the males and females are of similar habits and frequent the same places. But the males keep at a safe distance from the females, lest they be attacked by them. Though smaller in size, the males are more formidable looking and run more swiftly than the females.

Courtship

In the breeding season, the male idles here and there over the leaves or stalks of plants and grasses, or in bushes in search of a mate; while the female sits quietly under a bush or upon a leaf. When a male meets a female both remain stationary for some time. If the female moves, the male follows her keeping at a safe distance. If the female faces about, the male remains motionless as if dead. Presently the real courting begins and the entire operation takes a considerable time.

The observations I shall recount began about eight o'clock one morning at the edge of a stagnant pool at Kankurgachhi near Calcutta. I was squatting on a moist patch of land, when my attention was drawn to a small slender spider, which was moving in a peculiar dancing manner, repeatedly entering and leaving a small clump of aquatic plants and sometimes encircling the spot. It was not until later that I learned that his intended mate was lurking there. The male would advance toward the spot with very slow and cautious steps, counting paces as it were. He would raise his body to the maximum height and lower it again with a graceful movement of the pedipalpi, paying as it were homage to her majesty, with his head bowed down and both the pedipalpi folded. The pedipalpi were prominent and black, with femur and patella dorsally ornamented with bluish-white soft bristles.

Female larger

After a while, the spider advanced toward the bush, spreading his fore legs upward. Without stirring an inch from my place, but peeping through the plants, I saw what was happening inside. The female spider, much larger than the male, was resting on a floating Nymphoid leaf. When the male approached her, she raised her fore legs and chased him. The male kept quiet for a few minutes and then again approached her, dancing vigorously and vibrating his legs. If he appeared to be lacking in proper enthusiasm, the female would try to rekindle his interest by vibrating her hind or fore legs. The same procedure was repeated several times. Then, while the female still lay in ambush, the male, all of a sudden, approached her and clutched her tightly.

The preliminary dancing as I later learned sometimes lasts for hours; and the actual mating, in this case, continued for more than fifteen minutes. During this time, I managed to confine the pair, without disturbing them, in a glass tube. When the male released the female he remained motionless for a moment, then ran toward the end of the tube. Being unable to escape, he came back a few paces. Thereupon the female rushed upon her recent mate, caught him and stuck her fangs right through the cephalothorax. The poor animal died in a minute or two.

If one were to judge from her appearance and movements, the female was extremely furious. A few minutes later I introduced another male into the tube and the same lot befell it.

The female was kept in captivity, and after sixteen days she laid her eggs and encased them in a pea-like cocoon. It is curious that this specimen and all the others of various species that were kept in captivity, invariably laid their eggs at night. The mother spider under discussion firmly fixed the pea-like cocoon to her spinnerets and carried it continuously until the young were hatched, fifteen days later. Immediately upon emerging from the egg-sac, the young spiders, numbering 167 in all, got upon their mother's back.

Tenacious instinct

Once I detached the cocoon from the mother's spinnerets and put it at a distance. But the mother would not be separated from it. She attached it again to her spinnerets as often as I removed it. I pinned the cocoon to a lump of paraffin. The mother tried her utmost to snatch it away, and having failed attached her spinnerets to it and sat upon it. In this position no menaces would cause her to forsake her instinctive duty of guarding the egg-sac.

A mother spider cannot distinguish, however, between her own and another spider's cocoon. When her own cocoon was exchanged for that of a different species, the spider was quite satisfied with the substituted one. Several different cocoons, nearly of equal size, were mixed up. The mother spider was unable to recognize her own and was satisfied with whichever one she happened to pick up. It has also been observed that if an extra cocoon is offered, the spider will sometimes carry it with the side legs.

These amphibian spiders spend most of their time floating on water or resting upon leaves or stems of aquatic plants. But with the approach of evening they usually retire to land and seek shelter under cover of nearby vegetation. Sometimes they climb upon the leaves or stalks of grasses or creep under bricks and pebbles or into holes in the earth and rest there for the night. I could find no evidence of any retreat or resting place made by the spiders themselves either on land or in water. They are not regular weavers of webs or anything resembling them, but only spin a little for their cocoons. They are very quarrelsome. If a male or female happens to be in close proximity to another male or female a serious quarrel is inevitable. The duel ends in loss of legs, endangering the life of either or both of them.

The female lays eggs in a cocoon of a deep olive color, ornamented with several white spots. The cocoon is composed of two hemispherical cups of silk, joined together with loosely bound white web material, making a line along the equatorial region. With the gradual development of the eggs inside, this white band widens till it gives way for the exit of the young spiders. After coming out of the cocoon the young spiders flock into their mother's back and remain there for five or six days. These young ones are always in danger of their lives, for neighboring older spiders invariably kill them whenever they catch sight of them.

Fish hunters

Though they are of cannibalistic habit, these spiders prey principally upon the water-flies that float upon the surface of the water, the smaller dragon-flies, etc.; and they even hunt small fishes whenever there is opportunity.[1] After seizing their prey, they suck the juice out of it by inserting the fangs and crushing the victim with the powerful mandibles.

Sometimes they rest upon the clear surface of water, making little depression on the surface. They cannot walk slowly upon the water surface but cover wide stretches of water by quick jumps. But their most interesting activities are their maneuvers under water. These spiders, which have been identified as *Lycosa annandalai,* are only one of a number of kinds which have mastered in greater or less degree the aquatic medium, and provide a rewarding subject of observation for the naturalist.

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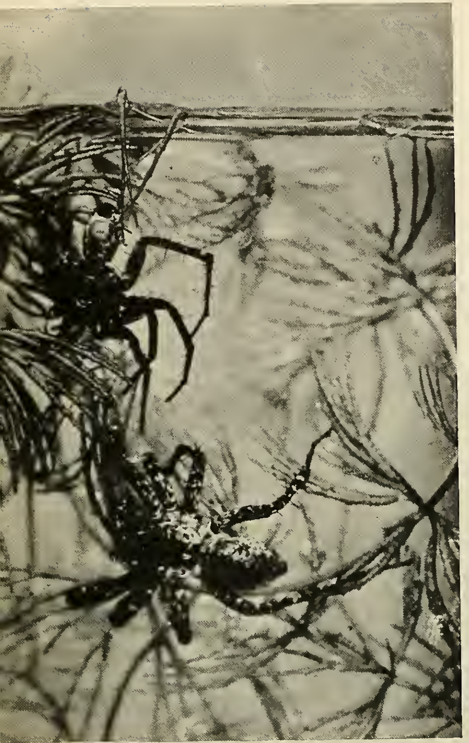
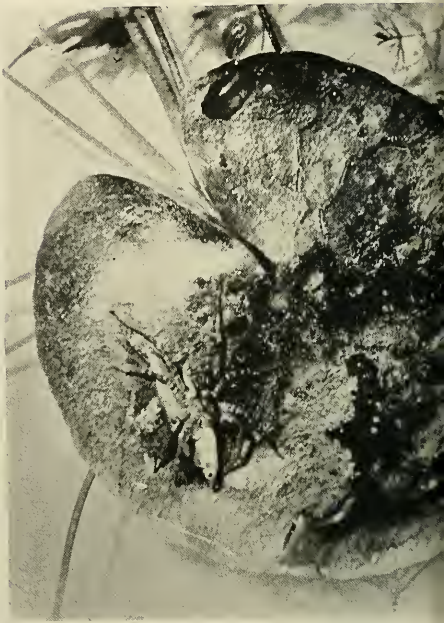
[1] The activities of spiders as fishermen have been described by O. Lloyd Meehean in Natural History for October, 1934, and by Dr. E. W. Gudger in Natural History for January-February, 1931, and in earlier issues.

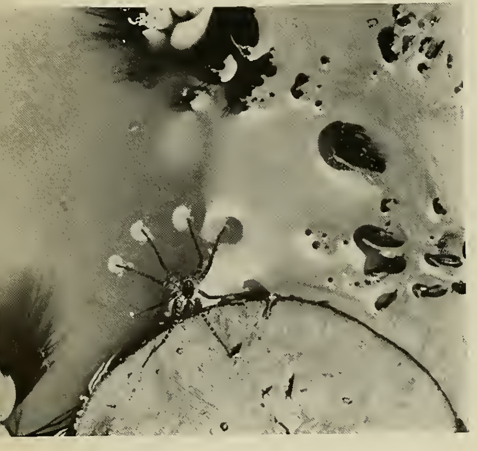
Diving

(Left) An interesting spider of India in a typical posture: Lycosa annandalai *which displays underwater tactics even more fascinating than the aerial maneuvers of the common varieties with which we are all familiar*





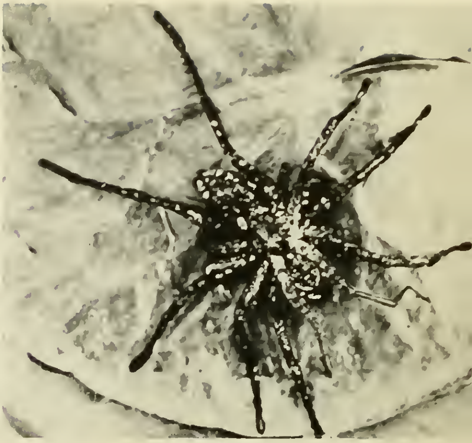
(Above) A spider with a true fish-story to tell. Although these spiders prey principally on insects, they also capture and devour small fish, from which they extract the juice by inserting their fangs and crushing the victim with their mandibles

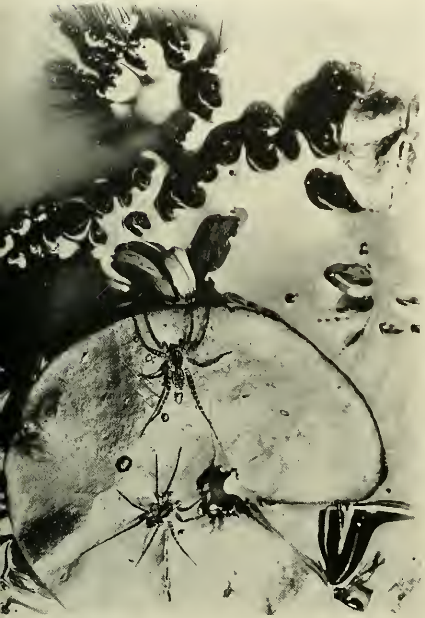


(Left) This spider is using the leaf of a water plant as a float from which to carry on his predatory activities. He searches the surface for water-flies and dives in quest of fish, remaining submerged for as long as twenty minutes

Spiders

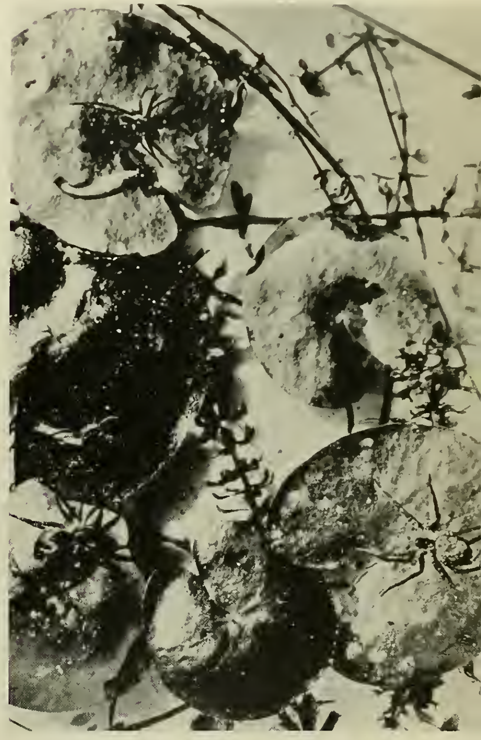
(Right) The mating of Lycosa annandalai. *The female was kept in captivity and after sixteen days laid her eggs and encased them in a pea-like cocoon. She would not allow this egg-sac to be separated from her during the fifteen days that preceded the hatching of her young*





In the above photograph the male is shown courting the female, which is the larger of the species. He approaches with slow and cautious steps, as though paying homage to her majesty. In the end the female kills her mate

(Right) A group of the spiders in their natural setting: males and females resting on Nymphoid leaves. At the lower right a mother is carrying her young ones, while at upper left and below, each spider has captured a fish



Science in the Field and in the Laboratory

Dedication of African Hall—Russian Eclipse Expedition—Meetings of Societies—City Bird Classes

African Hall Is Open

The dedication and opening of Akeley Memorial African Hall on May 19th was an event which many members have eagerly awaited.

The ceremonies were held in the Entrance Hall of the New York State Theodore Roosevelt Memorial, which adjoins African Hall. President F. Trubee Davison of the Museum presided before a large gathering of members and friends of the Museum and spoke on the distinctive features of this great exhibit. He gave acknowledgment to the various persons instrumental in the creation of the Hall and expressed the pride which all who have participated in it must feel in inviting the public to behold Africa, not as this or that person imagined it, but as it is.

President Davison introduced Mrs. Mary L. Jobe Akeley, who has been a vital force in the carrying out of the great dream which her husband did not live to see. Mrs. Akeley expressed her feelings in a brief paper, which because she was suffering from laryngitis, was read by Dr. Harold Anthony. Doctor Anthony, in turn, explained how the American Museum of Natural History has been a pioneer in the habitat method of exhibiting mounted animals, and pointed to African Hall as a climax in the development of museum art. He also described briefly the groups in African Hall and called attention to the precision that has been exercised throughout to preserve the effect of reality.

Dr. James L. Clark, who has been responsible for the entire preparational work connected with the Hall, was unfortunately absent from the ceremonies on a Museum expedition to Indo-China.

The great dream which Carl Akeley had of bringing Africa to America first stirred in him about a quarter of a century ago. When the dream was crystallized an African Hall Committee was formed on which Daniel E. Pomeroy has served continuously as Chairman. Mr. Pomeroy spoke at the ceremonies on the greatness of Carl Akeley from the point of view of an intimate friend.

Readers of NATURAL HISTORY are reminded of the January, 1936 issue of the magazine which was devoted to African Hall. Now open to the public, this superb display will acquaint thousands who might never otherwise see it with the wild beauty of Africa.

Doctor Fisher to View Russian Eclipse

On May 16th Dr. Clyde Fisher, Curator of the Hayden Planetarium, sailed on the Swedish-American liner *Drottningholm* for the first lap of his journey to Russia and Siberia. Doctor Fisher, as a member of the Harvard College Observatory Expedition, will take photographs and motion pictures of the total eclipse of the sun which occurs on June 19th, and which may be observed to the best advantage from the little hamlet in eastern Russia by the name of Ak-boulak. This eclipse will not be visible in the United States. While this total eclipse is an important phenomenon of great interest to astronomers in the study of the sun, it does not overshadow the second objective of Doctor Fisher's trip, which calls for a study of the great meteor craters in northwestern Siberia.

The Hayden Planetarium

During the month of June "The Midnight Sun" will be the subject of the lecture in the Hayden Planetarium. The demonstration will include a trip to the North Pole with several stops on the way to observe changing conditions as the latitude changes. The midnight sun and its apparent motions will be visible from the Arctic regions, as will also that beautiful spectacle, the aurora borealis or northern lights.

Amateur Astronomers Association

The Annual Meeting of the Amateur Astronomers Association on May 20th brought to a close the regular lecture-meetings for the season. The next regular meeting of the Association will be held on October 7th, after which lectures will be given on the first and third Wednesdays of each month. Members of the Association are hoping for fine weather and clear nights this summer. Trips are planned to astronomical observatories to examine observatory equipment, and, when possible, to look through large telescopes; other trips are to points on the outskirts of New York City for constellation study. These field trips begin with a visit to the Naval Observatory in Washington, D. C., on Memorial Day. All persons interested in obtaining notices of and further information about these amateur expeditions are invited to address the Secretary of the Amateur Astronomers Association at the American Museum of Natural History in New York City.

Junior Astronomy Club

Although the season of the Junior Astronomy Club was formally closed at a Jubilee meeting on May 9th, various activities will continue throughout the summer. The club is making a survey of the plans of numerous observatories for observation of the eclipse of June 8, 1937. This unusual eclipse will have a seven minute period of totality and will be unequalled for a thousand years except for the eclipse of 1955.

Meteors, variable stars, and other sky phenomena will be watched by members who will pursue their individual observations during the summer months.

Close Neighbors of the Earth

Between the orbits of Mars and Jupiter there is a belt of tiny planets called minor planets or asteroids. The total number of asteroids has been estimated at between 40,000 and 50,000. All of those observed go around the sun in the same direction as that in which the major planets move.

The astronomical world was interested in the discovery in 1898 of a small member of this group, which approached nearer the earth than Mars, and even nearer than Venus, which comes within 26,000,000 miles of the earth. This asteroid was named "Eros"; its diameter was estimated at 20 miles; and on account of the great eccentricity of the orbit, it was found to come within less than 14,000,000 miles of the earth. The orbit of this asteroid proved to be an improved yardstick in measuring the distance of the sun from the earth.

For more than a third of a century, Eros was the most neighborly of the known planets. But in March, 1932, an asteroid was discovered by Delporte of the Royal Observatory at Brussels, and later named "Amor," which is hardly more than 10,000,000 miles beyond the orbit of the earth at its closest approach. It is estimated to be not more than a mile or two in diameter.

In April, 1932, an asteroid was discovered at Heidelberg by Reinmuth, which approaches much closer to the earth than Amor. It is only about a mile in diameter, and at two points its path comes within three million miles of the earth's orbit.

In February, 1936, Delporte discovered an asteroid only about one-third of a mile in diameter, and consequently no bigger than a mountain on the earth. In fact, the asteroids in general have been referred to as "flying mountains." This tiny planet came within 1,500,000 miles of the earth, and is therefore our nearest known celestial neighbor except the moon and the meteors. After charting its path, Delporte named this newly discovered minor planet "Anteros," the mythological brother of Eros.

Early morning bird class of the American Museum of Natural History studying a northern water thrush in Central Park, May 12

City Birders

To the nature-loving New Yorker who is city-bound in the awakening months of April and May, Central Park offers surprising opportunities for study and recreation. To the expert, 100 spring species seen in the course of a month on two early morning rambles a week in Central Park may not seem especially significant, but to the New Yorker who longs to get to the country and cannot, it is thrilling.

The American Museum of Natural History, realizing the general interest in birds and the fine opportunities for study at hand in the Park, has been sponsoring, for the past five years, early morning walks during the migration season. To be greeted the middle of April by phoebes, robins, juncos, and even cowbirds after a long, cold winter is delightful. By this time, too, "Silver-tail," the albino grackle, is back to make his third yearly nest, and a flicker is loudly cuh-cuhing his approval of a maple to his mate for household purposes. Hermit thrushes, goldfinches, rusty blackbirds, and all too rarely a cardinal add their sweet voices to the middle April chorus. And on one dark morning a hump on a horizontal limb suddenly came to life in the form of a whip-poor-will. The sight of this bird, so seldom seen in the Park, was a real treat to the early birders.

One young enthusiast took to surprising the group with some pre-class discoveries. One morning he had spotted a yellow-bellied sapsucker at work and promptly led the group to the bitternut tree. The sapsucker, meanwhile, had disappeared and one student remarked that perhaps he had found the sap as bitter as the nut, but an even row of deep, little dripping holes in the trunk told the tale. Then some quick eyes spied him busily drilling at a neighboring tree, when we found that breakfast to a woodpecker came foremost on a chill morning, regardless of any curious lot of binocular devotees.

Last year two little screech owls chose an old pine near the West 77th Street entrance to the Park for their sleeping quarters. Upon first sight they looked like a knot on the rough bark, and the class was agog when they raised their heads and opened their large, sleepy eyes. Their admirers stop regularly this year to scrutinize the old pine, but so far without success. That is what makes birding so fascinating—the unexpected finds, the reunion with old bird friends, and the uncertainty of what may be in the next tree or around the corner.

As the migration season advances, birds come in a bewildering profusion. This spring a warm, south wind in the third week of April brought the first wave of warblers, golden-crowned and ruby-crowned kinglets, purple finches, blue-headed vireos, and others. Seeing thirteen species for the first time within an hour delighted the older students, whereas it dazed the beginners. In a month's time those seeking rarer species had heard the Cape May warbler sing his weak little song and the Tennessee warbler give his distinct "strident chappering." Some of the beginners had 75 life species to their credit—enough to keep them busy learning their habits the rest of the summer.

Although rare species of birds may still be seen in the Park, if there were more underbrush, soft earth, and green grass, as in former years, it is probable that many more would linger and rest in this city refuge while migrating. All New Yorkers who love birds and count them as their city friends should do their utmost to protect and improve the Park, to discourage vandalism, and to encourage and support the several sanctuaries that have been established.—Gladys Gordon Fry.

Meeting of the American Association of Museums

The Thirty-first Annual Meeting of the American Association of Museums was held in New York from May 11th to May 13th. On Tuesday, May 12th, the members of the Association were the guests of the American Museum of Natural History. In the morning a general session was held in the Theodore Roosevelt Memorial Auditorium, at which President F. Trubee Davison presided and greeted the delegates. At noon the trustees of the Museum tendered a luncheon to the delegates, and in the afternoon section-meetings were held in the classrooms of the School Service building. Some 400 were present.

Annual Dinner

The Annual Dinner of the American Association of Museums was the last event of the meeting and was held on the evening of May 13th in The Hotel Roosevelt. John H. Finley, associate editor of the New York *Times,* served as toastmaster and introduced the speakers, who included the following: Robert Cushman Murphy, of the American Museum of Natural History; Louis Cons, professor of French literature, Columbia University; and Vilhjalmur Stefansson, arctic explorer.

Doctor Murphy addressed the gathering of about 300 members and guests on the modern trends in museum aims: "Thirty years ago," he stated, "the museum idea had not . . . gone so far into the out-of-doors, much less into waves that travel around the earth via the stratosphere. . . . As I remember, many of the papers at the earliest meetings of this organization related to standardization of methods and equipment, a tendency which would have become the very bane of museums—institutions which must be individualistic and distinctive, if nothing else. What a revelation we have had this week in such more exciting titles as: 'The Film as a Museum Piece,' 'Showmanship in the Museum,' 'Research Service in the Museum Library,' 'Air Conditioning,' 'Infra-Red Photography,' and 'Objectives of Museum Work in National and State Parks.' . . . During the course of one short generation the whole museum idea has burst out from between the walls of discrete compartments, and from under solid roofs, and has entered the schools, camps, homes, even the forests, deserts, shores, and canyons of the wide world. Contrariwise, vastly more of the out-of-doors has been brought into the museums, so that indoors and outdoors are inextricably interwoven."

Doctor Murphy also pointed out some of the obstacles to the conservation of our national fauna and flora: "The settlers of our country were not originally woodsmen. They were husbandmen, traders, manufacturers, and they had been so for a thousand years in their old home. . . . These forbears of ours suffered, in short, from the fallacy of the inexhaustible. If forests were laid low, there were plenty more just beyond. . . .

". . . We are still largely possessed of a Yankee mania for drainage, which has been one of the most devilish of all our national habits. In the British Isles, as elsewhere in Europe, a marsh is treasured by any community, large or small. It is the place where the first spring blossoms emerge, and where gray herons, moorhens and waterfowl become almost as familiar and confident as barnyard birds. But in our own country the point of view of the 'realtor' has become so nearly controlling that most Americans look at a moist area filled with green rushes, meadow orchises, and pond lilies as something to be filled as promptly as possible with ashes, tin cans, and bedsprings. . . .

"But . . . we [in the museums] are not confined to the ordinary channels either of legalistic means or of scholastic education, and we well know that public opinion is far more effective than law."

The Fate of Grand Lake

In Rocky Mountain National Park, which was set aside in order to preserve in the National Park System a fragment of the most beautiful section of the Rockies, lies Grand Lake, the largest and loveliest lake in Colorado. But that beauty, and the existence of a large part of the present animal and plant population of the region is menaced by the proposition, now before the House of Representatives, to carry through the so-called Grand Lake—Big Thompson Transmountain Diversion Project. As outlined in hearings in the Senate, the plan provides for diverting water from the Colorado River in the southwestern corner of Rocky Mountain National Park through a tunnel under the continental divide into the Big Thompson drainage by a dam 190 feet high across a narrow gorge in the Colorado River. The Granby Reservoir, with 380,000 acre feet capacity, would be built at a cost of $1,370,000. The enlarged Grand Lake would be connected by a tunnel 68,700 feet long, nine feet in diameter, to cost $5,134,400. (Incidentally the estimate for the Moffat Tunnel was $6,000,000 and the actual cost $18,000,000.)

The cost of the entire project, including supply canals and a power plant, is estimated at $22,000,000. The water would be used to supplement existing irrigation systems which supply sugar beet areas now under cultivation.

Grand Lake will be ruined if this project is authorized, according to a letter received by Dr. H. E. Anthony from the American Planning and Civic Association, which points out that "the enormous amount of débris would undoubtedly create unsightly conditions of the worst sort near Grand Lake at the west side end of the tunnel and in the Park at the east end. See the entrance to Moffat Tunnel. The 8000 feet of conduit from the end of the tunnel to the east park line would introduce unsightly conditions which would last for many years and might never be obliterated."

The American Indian

A study of changes in American Indian population is under way in the department of anthropology at the American Museum. This study is based upon vital statistics for a number of Indian tribes in Canada and the United States over a period of fifty years, the compilation of which has been carried through by Mrs. R. D. Sanderson, honorary Life Member of the Museum. A brief report on this investigation has been published by Curator Wissler in the *Proceedings of the National Academy of Science*. This publication deals especially with the peculiar excess of adult women among the Cree Indians. It was observed that among one division of the Cree the sex ratio was 199 men to 243 women. In most populations of the world there are but small differences between the number of men and women. The publication issued is a discussion of the probable causes of this phenomena. It was discovered that among minors the number of males was but little less than the number of females, thus making it obvious that there was a higher death rate among near adult males. Further analysis of the data revealed that the high death rate for males began about the sixteenth year and continued to about the twenty-fifth year. There is no known disease that is selective in this way. On the other hand, the information concerning these Indians indicated that they were hunters and trappers and that most of the deaths among males for the period were believed due to accident and exposure. In brief, it was possible to show that this example of extreme differences between adult males and females was entirely due to mode of life. These Indians were first placed upon reservations about 1880, the statistics on their population begin a few years later, and since there was an even greater excess of women at that time than in 1934, we believe that under original primitive conditions there was a still greater number of women. In 1805 a fur trader reported that there were 76 men to 212 women. The significance of the data compiled by Mrs. Sanderson is that we see the hunting, warring life of the aboriginal Indian as especially destructive to males.

Incense Burner for the Morgan Collection

The Morgan Gem Collection has recently received as a gift from an anonymous donor a very finely carved incense burner made of leek-green aventurine, a massive variety of quartz inclosing minute flakes of mica.

This finely executed example of Chinese carving of the Kien Lung period features dragons combined with designs representing conventionalized clouds. It stands ten and one-half inches high, exclusive of its teakwood base, and was very evidently fashioned from a single block of aventurine, since the lines of color accentuation on the body of the burner extend without break into the removable cover.

Exhibits in Memorial Hall

Several interesting exhibits have been on view in Memorial Hall recently. From April 24th to May 18th, material used by Mr. Lincoln Ellsworth on his recent transantarctic flight from Dundee Island to a forced landing near "Little America" was displayed. The collection included a tent, sledge, supplies, and a model of the plane used. Other exhibits in May included one entitled THE SPRING MIGRATION IS ON, showing specimens of various migratory local birds, fish, reptiles, insects, and bats. An exhibit of various means of communication included an African drum, a picture of a smoke signal, a piece of wampum, birch bark writing, and natural history stamps. Another display that created public interest was arranged in connection with the fifth annual James Arthur Lecture on the Evolution of the Human Brain. This showed sections of the normal human brain and of a brain with tumors. A most timely exhibit was that of the life cycle of the tent caterpillar and of means of controlling this insect.

Geophysical Meeting

At the annual meeting of the American Geophysical Union held in Washington, D. C., April 30th-May 2nd, the Museum was represented by Dr. Robert Cushman Murphy, who took part in the sessions of the section of oceanography. These were presided over by Mr. Columbus O'Donnell Iselin, Commander of the research vessel *Atlantis*. Important aspects of the discussion were concerned with the submarine valleys of the coast shelf and with the new "wake current" theory which has an important bearing upon problems concerned with the Gulf Stream.

Next year it is hoped to plan a meeting of marine biologists on a day contiguous to that of the section of oceanography in order that men of science concerned with these interrelated matters may enjoy the opportunity of exchanging views.

Adult Education

The New York Adult Education Council held a series of three conferences on April 22nd, April 29th, and May 6th on "Current Trends in Adult Education." Mrs. Agnes K. Saunders represented the Museum at these conferences in which representatives from forty other organizations carrying on adult education programs participated. Mrs. Saunders spoke of the Museum's aims, methods, and flexibility, and of the success of adult education programs. Representatives from other museums of the city compared trends and problems in their respective programs. Mrs. Saunders also attended a dinner of the Council on May 4th at which Professor Lyman Bryson of Columbia was the presiding officer.

On April 25th she conducted a round table discussion in a conference on "Art Occupations in Industry" sponsored by the Institute of Women's Professional Relations. College student east of Chicago, educators, and professional men and women were invited to attend the conference. There were fourteen round tables covering broad fields of art such as Advertising, Lighting, and Movie Design. Mrs. Saunders spoke on the scope of natural history work, training required, and opportunities in the field. The conference was held at the American Women's Association and was attended by several hundred persons.

Visits of Crippled Children

During April and May the Museum was host to several hundred crippled children. On April 29th and May 14th some 500 children came from the public schools of New York City, some in wheel chairs and some on crutches, and attended a planetarium showing, were guided through the Museum halls, and saw the motion picture, "Sequoia." On April 16th thirty-two crippled children from Montefiore Hospital spent the day at the Museum, and followed much the same program. These are annual affairs and the enthusiasm and gratitude of the little visitors make their trips a pleasure to the Museum staff.

Credit

Owing to an oversight the Northern Pacific Railway did not receive credit for the use of the Indian pictures in the May issue of NATURAL HISTORY.

The New Books

The Study of Man—Percival Lowell—The Stars—Under the Sea—Gems and Minerals

A HUNDRED YEARS OF ANTHROPOLOGY. *By T. K. Penniman. The Macmillan Co. New York, 1936. 400 pp. $4.50.*

SOCRATES, it is said, first formulated that profound but now hoary dictum: Know thyself. But except for a few tentative gestures in that direction on the part of the fellow countrymen of the sage, man has preferred, until recently, to try to know all about everything *except* himself. Medicine, the only ancient science exclusively absorbed in man, cannot be said to satisfy Socrates' requirement since its development has been largely haunted by the specter of disease and abnormality. Under such pressure it has had little time for the less pressing if more fundamental principles which have shaped man, infused him with wisdom and folly, driven him into social units and governed his behavior.

It has, therefore, remained for anthropology among other newer disciplines to attempt to fill the need for a science of man. Its career has been like Topsy's; it has often had to clothe itself in hand-me-downs; some of its garments inadequately cover its rapidly growing frame; it has disturbingly spacious prospects; in other words it is growing and adapting itself. The history of such a movement should be an absorbing document. But curiously few exist and those few are unsatisfactory. Mr. Penniman has essayed the task and has produced a book which in some respects is by far the best I have seen for the field it covers.

The author has divided the history of anthropology into a formulary period before 1835, a convergent period from 1835 to 1859, a constructive period from 1859 to 1900 and a critical period from 1900 to 1935. The philosophical and social backgrounds which produced the beginnings of anthropology in the formulary period are briefly sketched in. The early anthropological classics of the convergent period are listed and discussed. To the giants of the constructive period tribute is paid, and they are conveniently tagged for the reader. And finally the young and not so young hopefuls of the present are mentioned. Throughout this account the influences of cognate fields on the development of anthropological thought are suggested.

I find the later period divisions rather artifical. The break between the constructive period and the critical is hardly real. I also find myself skeptical that Darwin's publication of *The Origin of the Species* provided as pervasive and as profound a motivation in anthropology as Mr. Penniman seems to believe. Without detracting from Darwin's glorious achievement and his very real influence in anthropology, there are, I think, enough examples in Mr. Penniman's own account to support the belief that much of modern anthropology has roots which go to an earlier period than Darwin. Like the Greeks, Darwin has become the *fons et origo* of historians. We tend to forget that Darwin, great as he was, was part of a movement which he synthesized and expressed more adequately than had been done before. Some of the ideas which he appropriated had in other fields already begun to sprout and produce tender shoots.

I am not erudite enough to know intimately the vast array of names which are marshaled in this book nor all the "firsts" in every field, but I seemed to detect a perhaps pardonable weakness of the author to over-stress the rôle of English anthropologists in the development of anthropology. For example, the impression is given that the English Haldane first enunciated the theory of the Asiatic origin of the B mutation in the blood groups. It is, of course, necessary that the author of a history covering so vast a field exercise some discretion in the selection of the protagonists of his account, but in view of the often lengthy treatment of relatively unknown and as yet insignificant names which are included I wonder why such important figures as Kroeber and Lowie entirely escape mention and why the profound studies of Boas on growth and environment are merely itemized perfunctorily.—H. L. SHAPIRO.

HIGHLIGHTS OF ASTRONOMY. *By Walter Bartky. University of Chicago Press, 1935. $3.00.*

THE AUTHOR, who is Associate Professor of Astronomy in the University of Chicago, has written this book for the astronomical portion of the Introductory General Course in the Physical Sciences, one of the four introductory courses under the new undergraduate curriculum in that institution, the object of these courses being to give the student a general educational background before he ventures to specialize in any particular field.

Doctor Bartky has given hundreds of lectures at the Adler Planetarium, and in the advertisement on the jacket we are told that he has sought to answer in this book some of the hundreds of questions people have asked him in his lectures at the Chicago Planetarium. These lectures together with his years of teaching experience have enabled him to prepare an excellent non-technical text without the introduction of mathematics. The material has been well selected, and treatment is clear and interesting. The author has unusual skill in presenting the results of mathematical investigation without the mathematical calculations.

The modernistic make-up of the book, many of its pages consisting of closely printed matter, with rather narrow margins, its chapter headings in small block letters, all tend to make the volume, according to this reviewer, somewhat formidable, which character is not deserved by the content. It is relieved, and made much more attractive, however, by many drawings by Chichi Lasley and by many astronomical photographs from the Yerkes Observatory.

Packed in 280 pages is a good working knowledge of astronomy, certainly a treatment adequate enough to enable any beginner to determine whether his natural bent would impel him to go further into the subject.

As an adjunct of the book, the author has devised an instrument, which he calls the "Stellarscope," for the study of the night sky. Through this ingenious and unique device, the stars and constellations are viewed on motion-picture film, illuminated and magnified. Each tiny sky-map, of which there are 24, is named on the film. By superimposing each individual film upon that portion of the sky, the exact identification of the heavenly bodies is made simple and easy. The "Stellarscope" is also distributed by the University of Chicago Press at the price of $2.00.—Clyde Fisher.

Autobiography of Percival Lowell. *By A. Lawrence Lowell. The Macmillan Co., New York. $3.00.*

The reviewer is not certain whether he should compliment the author for making his late brother tell his own story, or congratulate him on cleverly combining the narrative of Percival's life with the results of the Lowell Observatory's work on the planets.

The book is really in two distinct parts. One deals with the early life and travels of this remarkable person, who was gentleman, diplomat, correspondent, author, lecturer, business man, and mystic. The other describes the growth of a passion for astronomy that gave a new unity to his life, and culminated in the building, maintaining, and endowing of a great observatory.

From his graduation from college until he was 38 years old Percival Lowell traveled through Japan and Korea. He loved the East. He lived there as a native, and with a sympathy rare in an Occidental brought the East to the West by his delightful and inimitable pen.

As one reads the biography he sees that this was merely a period of preparation for the work Lowell was to do later. As a child he used a small telescope and read astronomical books. In college he had an excellent groundwork in science and mathematics.

Then came the sudden intention to devote himself to the sky. He organized and built his observatory. He realized that like an institution of learning an observatory is not merely a building, but involves a competent and sympathetic staff as well. Both these elements were combined and are there today in Flagstaff, Arizona as a result of the vision and ability of Percival Lowell.

The remaining half of the book quotes at length from the writings of this "amateur astronomer" and from the Annals of the Observatory. It describes the intensive work on Mars and recounts the growing conviction of Lowell that Mars is inhabited by intelligent beings. This, as some may think, was not a preconceived thesis to be proved, but a conviction arrived at only after much observation. The reviewer, like the author, cannot improve on Lowell's own words:

"To review, now, the chain of reasoning by which we have been led to regard it probable that upon the surface of Mars we see the effects of local intelligence. We find, in the first place, that the broad physical conditions of the planet are not antagonistic to some form of life; secondly, that there is an apparent dearth of water upon the planet's surface, and therefore, if beings of sufficient intelligence inhabited it, they would have to resort to irrigation to support life; thirdly, that there turns out to be a network of markings covering the disc precisely counterparting what a system of irrigation would look like; and, lastly, that there is a set of spots placed where we should expect to find the lands thus artificially fertilized, and behaving as such constructed oases should. All this, of course, may be a set of coincidences, signifying nothing; but the probability points the other way."

Next comes a period of study of the solar system and its origin; the evolution of the planets; studies in celestial mechanics on the asteroids; the rings of Saturn; and finally the prediction of a planet beyond Neptune. Even if it were a mere coincidence (which it probably was not), the finding of Pluto in 1930, fourteen years after Percival Lowell's death, completed his unfinished work. It is fitting that it should have been found at *his* observatory—and fitting that its symbol ♇ should stand not only for Pluto, but for Percival Lowell.

—Wm. H. Barton, Jr.

The Story of the Gems. *By Herbert P. Whitlock. Lee Furman, New York. $3.00.*

Scheduled for publication in June, 1936.
To be reviewed later.

The Book of Minerals. *By Alfred C. Hawkins. John Wiley & Sons, New York. 161 pages; $1.50.*

This little book is not "just another Mineralogy text book"; its appeal is wider and more universal than even the university. It fits into the pocket of Boy or Girl Scouts as well as it does into that niche in their brains that is reserved for things scientific. Those of us who are privileged to come into contact with the sons and daughters of the "man in the street" know that there has been a very considerable awakening of interest in minerals during the last decade. Doctor Hawkins' book does much to stimulate that interest; its lucid diction and well chosen half-tone illustrations appeal to the novice mineral collector, no less than does its moderate price.—H. P. W.

Twenty Years Under the Sea. *By J. E. Williamson. Hale, Cushman and Flint, Boston. 320 pages. 55 photographs. $2.50.*

For twenty years J. E. Williamson has been photographing sea-bottoms, staring at octopuses, sharks, and Hollywood mermaids through the glass window of his "photosphere." This "photosphere" is a refinement worked out by Williamson on a deep-sea salvaging device invented by his father. The perfected apparatus is a four-ton metal sphere with great glass windows, hanging at the end of a flexible metal tube.

In 1913 Williamson was "photographer, artist, and often reporter to boot," on a Norfolk newspaper, the *Virginian Pilot.* In the traditional manner of young newspaper men he harbored the hope of coming "upon the one big story that will surpass all other adventures." When he conceived the notion of modifying his father's invention, he forgot all his regular assignments. His mind was "crowded with the visionary scheme of taking pictures beneath the sea."

When he brought the first successful undersea photographs ever taken back to the office of the *Pilot* (which prepared a full-page Sunday spread) Williamson was already excited over the possibility of making moving pictures under water. The rest of his book is largely given up to accounts of his exploits in making submarine moving pictures and in collecting specimens for scientific institutions.

Williamson has gotten many fearsome and beautiful effects into his undersea pictures, such as the funeral cortège in *Twenty Thousand Leagues Under the Sea.* For the struggle between the octopus and the pearl diver in this picture he constructed a most ingenious cephalopod, with a diver sitting in its head, and with its fifteen-foot tentacles writhing under the pressure of compressed air. As might be expected this octopus showed none of the timidity which makes the real octopus a rather disappointing actor; and most of the spectators were as satisfied as the newspaper critic who affirmed that "there can be no question of fake or deception."

Mr. Williamson, among other adventures, has killed his shark, diving beneath it with a knife, in the good old Bahama fashion, but the most alarming experience he had was when he felt an anomalous shape crawling within his helmet. When he finally was drawn up to the surface he found that a scorpion had secreted itself in the helmet.

The photographs include magnificent coral groves, gaily striped tropical fish, fantastic scenes from under-water motion pictures and an abundance of sharks.

While Mr. Williamson makes no pretense of being a scientific observer, and is certainly overgenerous in the use of expressions like "man-eater" and "monster," his book is continually entertaining, and sometimes exciting.—G. L.

A World of Chance. *By Edward Gleason Spaulding. The Macmillan Co., New York. $3.00.*

This book is an argument for a thorough-going Indeterministic position as regards the Structure of Reality, to include in the meaning of this term not only Nature, but also that realm of fact which is not part of Nature, but of which, conversely, Nature itself is an instance." To his own questions Whence, Whither, and Why, Professor Spaulding finds the answers From no Source, To no End, and For no Reason. He considers that this is a Pluralistic universe and that the World, in the broadest sense, is a world not of necessity, but of chance.

Recent Museum Publications

NOVITATES

No. 837. A Classification and Phylogeny of the Elasmobranch Fishes. By E. Grace White.

No. 838. The Heart Valves of the Elasmobranch Fishes. By E. Grace White.

No. 839. *Pagothenia,* a New Antarctic Fish. By J. T. Nichols and F. R. LaMonte.

No. 840. African Bees of the Genus *Allodapula.* By T. D. A. Cockerell.

No. 841. Records of North American Gnaphosidae with Descriptions of New Species. By Ralph V. Chamberlin.

No. 842. The Australian Ant Genus *Froggattela.* By William Morton Wheeler.

No. 843. African and American Oligochaeta in the American Museum of Natural History. By W. Michaelsen.

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No. 845. A New Genus and Species of Fulgorid from Haiti (Homoptera: Fulgoridae). By Herbert L. Dozier.

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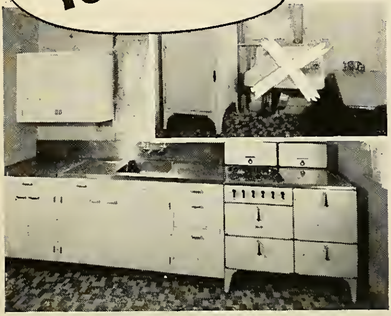

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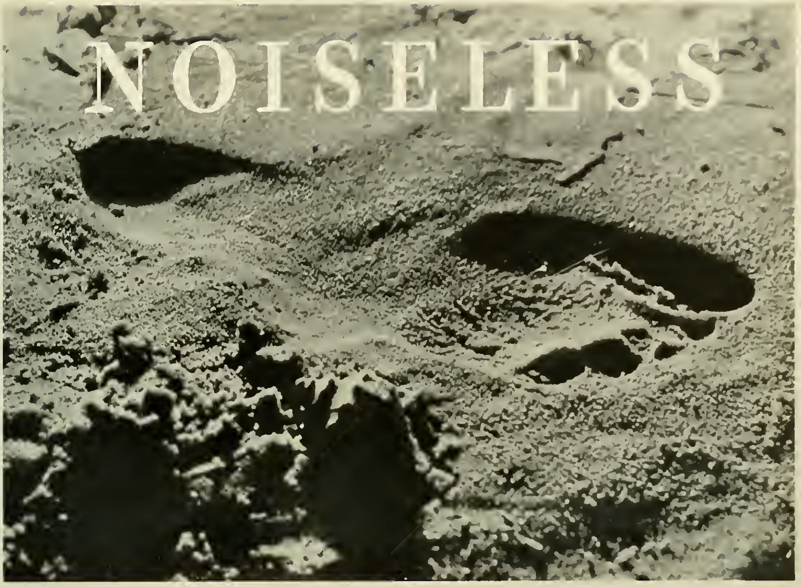

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The Magazine of the American Museum of Natural History

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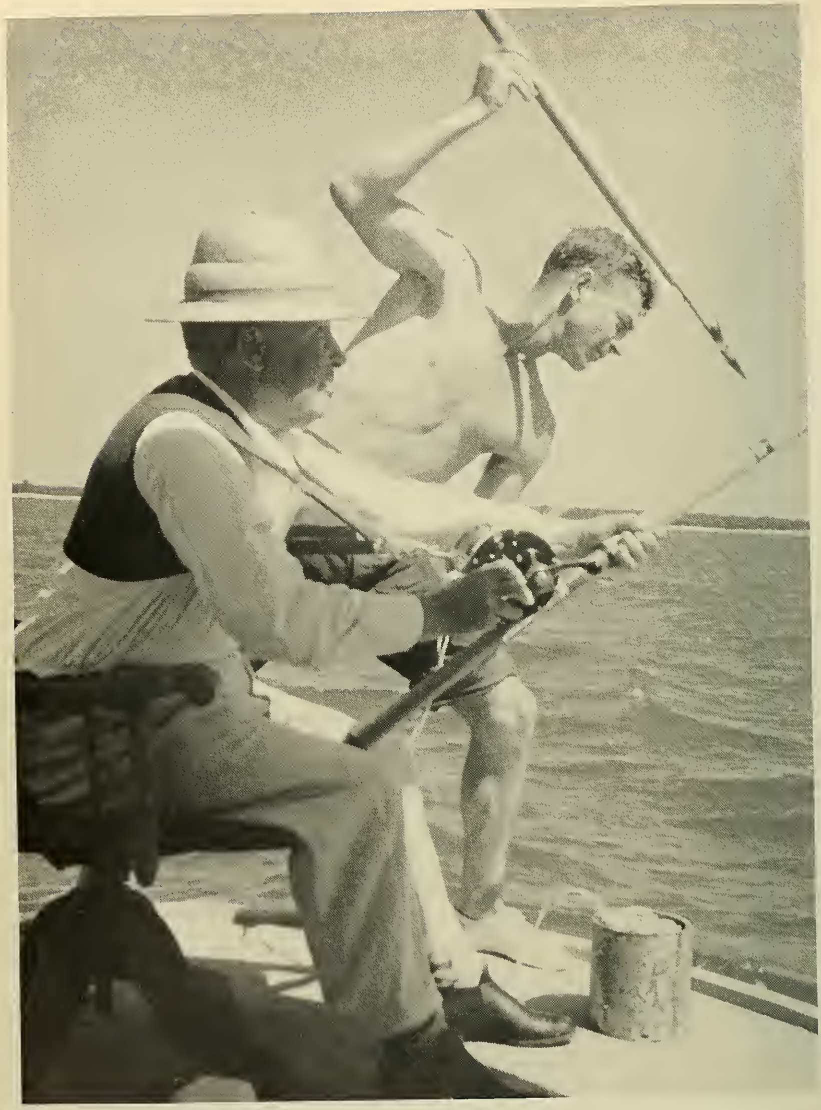

He Gets the Iron

Showing the latest tactics used against the most hated and feared creature of the sea: Colonel Wise, toward the finish of a hot fight, ready to land a shark by the unusual technique which he has perfected

Tigers of the Sea

The truth about sharks, told by a man who has devoted years to outwitting them. The first of a series of three articles

By COLONEL HUGH D. WISE
U. S. Army, Retired

A COMPENSATION for hardships and uncertainties of active Army Life is the opportunity it affords for sport with rod and gun in many parts of the world. I have taken full advantage of this but omit here discussion of all but shark-fishing which I have pursued at home, in Cuba, in the Philippines, in Hawaii and in the Bahamas.

My first exciting experience with the shark was as a youngster in my early teens. I used to go out on Matompkin Inlet, on the Atlantic side of the Eastern Shore of Virginia, with a crew of market fishermen. Those were wonderful days, when glorious fishing always ended in a sailing race between the fishing boats up Folly Creek to Drummondtown, each boat trying to be first to market.

Taken for a ride

One day, boy-like, I had gotten into the dory swinging astern of the "bateau" "Lottie Garrison" and was fishing there when a big Hammerhead whizzed past, turned and began slowly circling the boats. From my pocket I took a large hook which I had treasured there for weeks, tied it onto the end of the painter of the dory which was simply looped over a cleat on the "bateau." I baited it with a weakfish and cast out. As it floated on the surface fifty feet away, the Hammerhead on his next turn took it with a gulp—"Snap!"—The painter tightened and the dory's bow went almost underwater, bobbing up and down, while its stern skidded crazily from side to side. I managed to whip the loop free from the "bateau," scrambled over the thwarts to the stern of the dory, and got an oar into the sculling groove. So, holding the dory head-on, I was taken for a ride at speed hitherto never experienced by me in a small boat, for motors had not then been invented.

"Where the—do you think you're going?" shouted Captain Billy Milner, as I scudded past. This was really a useless question, for no one could have had less idea than I had of where I was going. I was on my way, however, and I was going fast.

In chase

I seem still to hear the unparliamentary remarks shouted after me by that salty crew whose fishing I was spoiling at the very best of the tide, for Captain Billy, who felt some responsibility for me, had ordered fishing lines in and sails up. Overboard went his cable and he was after us, but we had a half-mile start before the "bateau," leaning to the breeze, was under headway.

In a mile or so they had nearly overhauled us but my tug then suddenly changed its mind and we shot off to windward, giving our pursuers a two-mile beat of it before Captain Billy grabbed the dory's stern with a boat-hook and his crew dropped sails. Then shark, dory and "bateau" moved in procession at a somewhat slower speed until strong arms hauled in the offending shark and murdered him. By this time the crew, in the excitement of the chase, was no longer murderous in its intentions toward me and I was thrilling with delight at the sport I had given them, quite unpenitent of having spoiled their morning's catch. On the contrary, I think I was proud of having provided such an incident. From that time on I have been a confirmed shark-fisher, but was too closely watched by Billy ever again to play that game when out with him.

This shark had every temptation to attack the little dory, but he did not do it, nor since then, under similar circumstances, have I seen one do it. A lameness which I brought home with me from the World War put an end to my hunting and to my fishing on foot, but there had to be outlet for the sporting instinct developed in me by a life of service in the army with hunting and fishing around the world. Bass-fishing and blue-fishing were still practicable and I enjoyed them but, in Hawaii and the East, I had had a taste, a good big taste, of angling for heavy sea fish and this had somewhat marred my zest for pursuit of smaller varieties. Pegging away to find what I could do, I soon learned that though my stream-wading days were done, I could still be "hell in the swivel chair!"

For many years I had had fun fishing in various ways for sharks, but now I took to angling for them with rod and reel at times when I could not reach other big fish and, in so doing, I developed for myself the somewhat unique or at least unusual game which I shall describe later.

Glamourous combat

There is a glamour to this fishing which comes with no other angling. I have tried to analyze its fascination, which seems really to be the zest of combat with the "Tiger of the Sea," for whom there is no feeling of pity to mar the exultation of victory. Even for the swordfish, which may be as big and as strong as most sharks, one feels a regret when he is killed; but, for the shark, there is no compassion—he is a pariah. When he is brought up, his glaring amber eyes evoke no feeling of kindliness and his snapping jaws, with dreadful dagger teeth, convey only the impression that he is an armed enemy who would give no quarter and who is entitled to none. From the moment when he takes the hook, his capture is a fight—a fight which excites the lust to kill a predatory creature whose life is a menace to all other denizens of the sea, and whose death will make the angler their protector.

A question sure to be asked when sharks are mentioned is: "Do sharks attack and kill men?" Whatever be the reply, there is likely to be a dispute, because the question, in such simple form, cannot be definitely and authoritatively answered.

Sharks do not go forth to stalk men as cats do mice nor to catch them as wolves do deer. Fish are the regular victims of even the most predatory sharks, and man, though probably an acceptable morsel, would be a most unexpected addition to their menus. Nevertheless, sharks do occasionally get him.

We can only guess at how much truth there may be in the yarns we hear of shark attacks, but there must be a more solid foundation than superstition and imagination for the general and real fear of sharks shared by practically all watermen, though few of them can cite cases of shark attacks within their own personal knowledge.

Killings

There are countless instances of the eating of dead men by sharks, and there are many reports of their attacks upon live men. Both our War Department and our Navy Department officially report several such killings. Governor Pinchot tells of one such in Tahiti, and Captain William Young has collected in his book some authentic reports. Nevertheless, I have repeatedly seen soldiers from transports, in shark-infested waters, swimming unharmed about the ship and thousands of tourists watch natives diving for pennies at tropical ports, where harbors are teeming with sharks, without ever seeing a diver harmed by one.

Probably the most dangerous species in our North Atlantic are the Great White Shark, the Great Blue Shark, and the Tiger Shark, none of which is really common in our waters, but it seems to be a generally accepted fact that sharks are more dangerous in the tropics where, incidentally, these species are common.

To get facts in this much contended question of shark attacks on man, Mr. Herman Oelrichs, some years ago, offered, through New York papers, a reward of five hundred dollars for authentic information of such an attack in our waters, but the reward was never claimed. Similar rewards were later offered, and a number of papers took up the discussion which brought to light no credible instance in our zone though there were a number in tropic waters.[1]

The late Dr. F. A. Lucas, of the American Museum of Natural History, quite thoroughly investigated this subject and he believed that the danger of being attacked by a shark in the vicinity of New York is "infinitely less than that of being struck by lightning." Nevertheless, periodic shark scares persist, and in one of these, in 1932, newspapers published alarming casualties on our bathing beaches. Some resorts even safeguarded swimmers by wire fences in the surf and the barbs of these were probably more dangerous to the bathers than were the teeth of sharks.

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[1] Brooklyn Museum Bulletin, Vol. 3, No. 1.

At the height of this excitement Mr. C. M. Breder, Jr., of the New York Aquarium, made a trip to study conditions in local waters, but found sharks no more numerous nor ferocious than usual and he concluded that most of the panic was probably due to publicity and exaggeration and that at that time there was not an authentic case of attack by sharks in our region. It is quite necessary to realize that there is a difference between shark bite and shark attack and that lack of caution may, and often does, result in severe laceration from the teeth or in a terrific wallop from the tail of a frightened or wounded shark.

Danger zones

In some parts of the world sharks are much more dangerous than they are with us and Dr. C. H. Townsend, Director of the New York Aquarium, has furnished an article* which should remove all skepticism as to whether sharks will attack men. He cites numerous instances in which men were attacked and devoured and tells of cases where not only were swimming men seized but also where sharks grabbed the oars or outriggers of boats.

In Polynesia, the almost amphibious natives regard the shark with a dread akin to that of the African for the lion, though the shark takes less toll in human life because he cannot stalk his prey, as does the lion, on land.

In Australia, the shark is a greater danger than he is with us. Especially is he a menace in Sydney Harbor where his predatory habits have doubtless been encouraged by the custom of disposing of slaughter-house refuse in the bay and so chumming up the sharks.

In the Solomon Islands, sharks are singularly bold and ferocious, which may be accounted for by the custom of disposing of the dead by throwing their bodies into the sea—thus literally training the sharks to eat men.

Interesting conclusions of Doctor Townsend are that sharks of tropical waters are more ferocious than those of temperate zones, that sharks are more dangerous at night than in day, and that the most dangerous time is dusk. Also he believes that large sharks are not necessarily more dangerous than those not so large and that all sharks are particularly dangerous when swarming on feeding grounds.

This all seems to confirm my own belief that, while sharks do not set out on man-hunts, they will, under favorable circumstances, attack man, especially if impelled by hunger, excitement or the blood-scent, and that they are particularly dangerous when in feeding swarms.

It is going a little strong to say, as recently did one scientist, that a shark will not attack man unless he gets the blood-scent for, though that unquestionably excites him, there are many authentic cases where he has attacked without it. Nevertheless, it is my opinion that a shark, except when surprised, attacked, or greatly excited, rarely attacks a man whom he does not believe to be dead or helpless; and I believe that, except in self-defense, a shark prefers to avoid anything which might fight back. It is prudent, however, not to risk being the victim in an exceptional case. Since the angler, if he accepts my advice, will try to stay in his fair-sized motor boat, the man-eating tendencies of sharks are not of immediate importance, nor is it here necessary to convict or acquit the shark of anthropophagy. Suffice it to say that I do not recommend him as playmate at a bathing beach.

A bad moment

On one occasion in the Philippines I was shark-fishing from a canoe. A big Tiburone was towing us around, when he suddenly turned and rushed head-on against the boat. His impact threw the two paddlers and me into the bottom of the boat and, as I wallowed there, I had a distinct sense of relief when I felt the rope tauten as the shark, having swung away, took up the slack. This might make a fine story of a shark attack, but I am afraid that I will have to admit that the shark had no intention of attacking that boat but simply collided with it in his frantic efforts to escape.

This large, ubiquitous and abundant fish which, except to a few sportsmen, has for centuries been but a nuisance, has recently become of economic value, and commercial companies are now engaging in shark-fishing as a profitable enterprise. Their catches taken in large specially constructed nets, are measured by tons and practically all of this weight of fish is utilized. Formerly, shark hide or "shagreen" was used mainly as an abrasive, like sandpaper, and it was of great service for cleaning decks. Its non-slippery quality made it useful for sword hilts and tool handles and its durability for bags and pocketbooks; only recently a process of tanning was discovered which effectively and economically removes the denticles of the skin, and thus converts the hide into a beautiful leather of superior toughness and durability, called "galuchat."

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*Bulletin 34, N. Y. Zool. Society, Vol. XXXIV. No. 6, 1931.

The liver of a shark may be a fourth or a fifth of his weight and oil from the liver, about four gallons from a six-footer, is used in tempering steel, in paint, and in many other commercial ways. Medicinally, it has been found to possess vitamins which make it a rival of cod liver oil.

Shark as food

Dried fins, used for the famous shark-fin soup, bring good prices wherever there is a Chinese population, and quantities of them are exported to China.

Certain varieties of shark whose flesh is especially fine of texture and delicate of flavor, are marketed as "steak fish" and "grey fish," others are salted and packed, while plugs punched from shark steaks and ray fins and doped with clam juice, become "deep sea scallops." The less desirable flesh is dried and ground into poultry meal and the remainder is reduced to fertilizer.

The prejudice against eating shark meat seems largely due to the idea that sharks are scavengers as, in fact, some of them are, though no more than most other fishes and crustaceans, especially crabs and lobsters; and I know of at least one famous trout pool which is close to a sewer outlet. Many people enjoy shark meat without suspecting what they are eating.

Once, while watching my boatman skin and trim a two hundred pounder, I asked, "What are you going to do with that shark?"

Grinning, he replied, "This was shark—now it is just fish—tomorrow, in the market, it will be swordfish."

A serious charge against the shark and one which can be sustained, is the great damage he does to fish-traps and nets, and the tremendous toll he takes of fish which men want for themselves. This indictment of the shark may serve to salve the conscience of the sportsman who goes forth to assassinate him. Certainly it will make easier the getting of bait because seinemen are ever ready to contribute trash fish for a fight against their arch-enemy.

One of the sea's leviathans

The shark belongs to one of the largest and commonest orders of fishes of the present times and is also one of the oldest living vertebrates. He has come down from past geological ages little changed except in size, for, big though he now is, he was larger then, fossil remains showing that he may have been over a hundred feet in length.

One almost needs logarithms to calculate the weight of such a fish but, since his length, exclusive of caudal fin, would be about 974 inches and his girth about 450 inches, his weight, by a rather reliable formula, would be:

$$\frac{450^2 \times 974}{800} = 246{,}543 \text{ lbs. — or about 123 tons}$$

Such conjectures aside, there is in the American Museum of Natural History the reconstructed jaw of one of the leviathans which swam the seas when glaciers covered the northern part of our continent. The fossil teeth of the *Carcharodon*, averaging 4¼ inches in length, found in the Tertiary deposits of North Carolina, are set in a jaw modelled after the jaw of the White Shark, his nearest living relative. This jaw would easily take in a four-poster bed and, from the estimated length of the fish, we can calculate his weight as over thirty-eight tons.

It is remarkable how little is known of the habits and characteristics of this oldest and largest of our common fishes. Even Garman, the recognized authority on shark taxonomy, barely touches upon this subject. Sharks have swum the waters of our globe for more than three hundred million years but much about them still remains a mystery. Let a man embark upon an investigation of them and he will soon find himself engulfed in such a welter of scientific fact, unsubstantiated legend, imaginative folk-lore and plain garden variety of fish story, that he is hopelessly swamped. He will probably conclude that he is dealing with "all kinds of a fish" as, in fact, he is, for the order, Plagiostomia, includes the huge Manta and the little Skate, the great Whale Shark and the small Dogfish, the vicious White Shark and the cowardly Nurse. There are among the sharks deep-sea flesh-eaters and shoal water mollusk-feeders. They are found beneath Arctic ice and on tropic coral reefs. They cruise mid-ocean and haunt the waters of coastal marshes, but, wherever sharks may be, they are undisputed masters, and upon their slithering approach all other denizens fin away. Whether harmless to man or a menace to him they are hideous and they are hated.

Face inspires dread

There may be justification for this hatred of the savage predatory shark and for the descriptive "hideous," usually applied to him, but in fact it is only his face, with leering sinister eyes and dreadful spiked teeth, which makes him hideous, otherwise his graceful form and delicate shade would make him beautiful. No creature of the sea is so gracefully lithe as the shark, silently gliding through the water, but none is so terribly fearsome as he when he dashes at his prey.

In his physical structure, the shark is highly specialized to meet conditions under which he exists, while, as a vital organism, he presents some features which are almost unique. Conspicuous among these are his spiral valvular digestive tract and his dual organ of reproduction. For a fish, he has a well developed brain, his sense of smell is acute and his hearing is supplemented by nerves, which are extremely sensitive to vibration.

There is no air-bladder, as there is in most fishes, so the shark, deprived of this means of changing his specific gravity, must regulate his depth by muscular effort, in other words, by swimming; he is therefore rarely seen quiescent.

In nearly all species of true sharks, a long, lithe, muscular, fusiform body tapers from its largest part, about a third of its length back of the nose, forward into a pointed conical head and aft into a long, round, graceful tail or peduncle, which terminates in a large swallow-tailed caudal fin, or fluke.

Different from the swimming of most fishes and characteristic of that of the shark are the sinuous undulations of his body by which he supplements caudal-fin propulsion and this gives to him a peculiar slithering, ghost-like glide. His litheness is in large part due to the absence from his body of stiff bones, for his frame is mainly of heavy cartilage; his only fossil remains are the enameled-covered teeth.

Over his cartilaginous framework is stretched his truly marvelous muscular system covered by a denticled hide, so tough and so protected by small, close-set, horny scales as to defy all but sharp, well tempered instruments and almost to justify the saying that "only a shark can bite a shark."

The first dorsal fin, usually large and erect, is much larger than the second dorsal, the anal and the ventrals. Pectorals are usually long and sickle-shape. The size, shape, and position of all of these fins vary with different species and are to be noted as important clues to identification. Only the caudal fin, which is also important for identification, is important in propulsion; other fins being used mainly for balancing and guiding.

Near the ventral fins, in male sharks, are found the "claspers," which might be mistaken for fins but which, in fact, are sexual organs.

Gill-openings are usually five (in some species, seven) parallel vertical slits which are not covered as in other fishes, and the spacing of these slits is another clue for species identification.

Teeth

The mouth, situated beneath the head, the nose projecting well beyond it, gives to the shark the familiar, disagreeable "overshot" expression. The mouth is of enormous size and is sometimes supplied with as many as seven visible, parallel, curved rows of teeth. Only the front two or three of these rows are functional, those in the rear being in successive stages of development and inclination backward while still more rows have not made their appearance. The teeth are not set in the bone of the jaw but grow from the hardened skin of the mouth. As this skin grows forward the teeth develop and rise to vertical position and the rows are successively shed over the front edge of the mouth. The fish is thus constantly provided with new dentition and this explains why so many shark teeth are found on the shore and why fossil teeth are so abundant.

The difference between teeth of species is a valuable means of identification as well as evidence of the habits of sharks of each species.

Most sharks either bite and swallow their food down large gullets, as do the White, the Blue and the Mackerel, or they crush it as do mollusk-eaters, like the Nurse and the Dogfish—none of them chew and masticate. Some species, notably the great Whale Shark[*], feed on small fishes, jelly fishes, small crustaceans and algae which pass down their small throats after being strained from huge volumes of water by their gill-brushes. For obvious reasons, their teeth are small, and one family, the Basker, substitutes for teeth a brush-like apparatus which serves as a sieve.

Even in the group which we may call "biting swallowers" there are different tooth shapes for the different species and this helps distinguish them. The Mackerel Shark has long pointed teeth, the White has broadly triangular ones; the Hammerhead combines these puncturing and cutting qualities in his narrow triangular teeth and the Tiger Shark's teeth are large, broad and sickle-shaped. The broad and rather flat teeth of mollusk-feeders are set like paving tiles and sometimes are practically jointed together.

Fast swimming species feed usually on live fish which they pursue and capture, but slower ones may have to content themselves with mollusks, crustaceans or even with offal. In general, however, the shark is not a carrion feeder.

One objective—food

With their equipment for offense and dedense, sharks have naught to fear in the sea where no other fish will attack them, where their only danger is from other sharks, where their whole existence is but a continuous search for food to satisfy insatiable appetite. The shark is always hungry—he suffers from incurable belly-ache. Be it live fish, dead fish, flesh or fowl, all is grist for the shark's mill and he is always on a predatory prowl after it. Never does he seem to rest. His big fins appear above the surface, or beneath it he slithers in from nowhere, but he is always headed for the same objective—food.

What may be the span of the natural life of a shark is yet undetermined for he has no scales, whose rings might tell his age, and his teeth are but temporary equipment. It is doubtful, however, whether many sharks live out their natural lives for, if ever they lose, even temporarily, the capacity to defend themselves, other sharks are quick to kill and eat them.

Sharks are the most cannibalistic of cannibals and in large ones are often found smaller ones which have been devoured. Dr. E. W. Gudger, of the American Museum of Natural History, has published a most thorough and instructive paper on shark cannibalism, in which he shows that practically all sharks prey upon other sharks as well as upon their cousins, the skates and rays.[*]

Powers of digestion

I once saw taken from the stomach of an eight-foot shark, a three-footer which had been swallowed whole. To appreciate that gastronomic accomplishment, one must remember not only the size of the morsel but also the sharp teeth, the hard stiff fins, capable of cutting a heavy line, and the tough denticled hide which defies ordinary tanning processes. One wonders at gastric juices which can digest such things as are taken from the stomachs of sharks; for example, a horse's hoof with the iron shoe on it—the bones had been completely dissolved, the horn casing was softened to the consistency of leather and the iron was being rapidly corroded. Could doctors use shark juice instead of pig juice to get pepsin? In this digestive fluid there is a very high content of hydrochloric acid, and I have seen it remove the varnish when spilled on a deck.

Nevertheless, we read in Darwin's *Voyage of the Beagle*—"I have heard from Doctor Allan, of Forres, that he has frequently found a Diodon[†], floating alive and distended in the stomach of a shark; and that on several occasions he has known it to eat its way, not only through the coats of the stomach, but through the sides of the monster, which has thus been killed. Who would ever have imagined that a little soft fish could have destroyed the great savage shark?"—Who would imagine it? We must say, like Charles Dana, "Important if true," but we may conjecture at least that the Diodon had an uncomfortable swim.

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[*] Dr. E. W. Gudger has written on the Whale Shark in the following numbers of NATURAL HISTORY: January-February, 1923, p. 62; March-April, 1930, p. 182; September, 1935, p. 128; and February, 1936, p. 159; in Bulletin of the American Museum of Natural History, 1935; and in Novitates No. 318, 1928.

[*] Gudger, E. W.—"Cannibalism among Sharks and Rays," *Scientific Monthly*, May, 1932.

[†] A species of puffer fish.

It is not uncommon for sharks to attack another shark when he is held on a line and to bite great chunks out of him and it is still more common to find sharks which have been partially devoured while they were enmeshed in nets. Apparently, they live in armed neutrality, but when one of them becomes disabled or helpless his comrades give him short shrift.

Speaking of the slashing of one shark by another brings to mind the old superstition that a shark must turn on his back or side to bite. To one who has watched sharks take the bait and who has seen them bite one another, this is, of course, utter nonsense. A shark's eyes are not well placed for forward-downward vision, so he may have to roll for better view; and, frequently, the roll is but the preliminary of his dash at an object.

Another foolish idea is that female sharks swallow their young to protect them, disgorging them when captured. The fact is that, on capture, viviparous females often give birth to their young and, incidentally, it may surprise you to see how self-reliantly the pups swim away when tossed overboard.

An arrant coward

Contrary to popular idea, the shark is wary, almost timid, for monster though he is, he is averse to taking chances. He is however, possessed of a curiosity which sometimes urges him on and makes him appear bold when, in fact, he is terrified; but at heart, if his heart be aught but a blood-pump, he is an arrant coward.

Nothing could better illustrate the curiosity and the timidity of sharks than an incident related in Captain Young's book. A diver working with him in Hawaii was constantly surrounded by curious sharks which, however, did not molest him; but, when they nosed up uncomfortably close, the diver released some air bubbles from his wrist-band and this sent them gliding away.

Even a large shark, with a large skull, has but a handful of brain-matter for the brain-cavity is only partly filled. Nevertheless, this handful seems to provide him with a disproportionate amount of suspicion and with perception enough to beware of a bait tied onto a string. I have seen sharks rush furiously up to a bait then stop, draw back and examine it, but they would instantly seize and gobble an identical free bait floated out to them.

Usually a shark does not take the bait with a rush but will first seize it in his teeth before swallowing it. When, however, he has decided, he takes it with a gulp.

Blood lust

However hesitant sharks may ordinarily be, all hesitation leaves them with the smell of fresh blood, which puts them into a frenzy. Testing this one day when several sharks were cautiously nosing at my bait, I poured over the boatside some blood from a recently captured shark. Instantly one of the investigators seized the bait and the others went frantic. Taking advantage of this characteristic, I have always since then bled newly caught sharks over the gunwale, usually with good results.

Under skin-flaps in the anterior portion of a shark's head are two large nostrils and as his olfactory organs are excellent, his sense of smell is acute. He gets the blood-scent at amazing distances and rushes toward it. Literally, it seems to make him see red.

For this reason, blood is good chum and there is no better chum than the warm rich blood of the porpoise, though any blood, from fish, fowl or animal, will attract sharks.

When not excited by the blood-scent, sharks are surprisingly wary and alert. As they circle the boat, their unblinking yellow eyes are ever on watch, and their sensitive nerves are always atune. A wave of the hand or a sudden noise sends them gliding away, to return, probably, when impelled by irresistible curiosity or insatiable appetite.

By "noise," I mean vibration or jar in the water, for I have observed that they do not seem to be afraid of other noises, such as loud talking, for example. To try this out, I have even shouted at sharks swimming close to the boat without alarming them in the least, but a bang on the boat-bottom sent them dashing away. Nevertheless, for some unknown reason, talking seems to make them timid about taking the bait.

Most sharks are very moderately gregarious but, where one is found, there will probably be others, temporarily together, because their individual searches have led them to that place on the trail of food. When their maws are filled, or when the possibilities of the locality are exhausted, they will leave to resume their ceaseless prowls in search of more food.

In most sharks there is little instinct to school, like the bluefish for example, though some of the smaller species do at times swarm, and Nurse Sharks and certain Sand Sharks assemble in great numbers in shallow water at breeding season.

No admirable traits

Being masters of the sea, sharks need not join for defense; community of interest does not exist in their selfish, individualistic natures, and, in their lives, every fish is for himself. Most animals and many fishes unite against common foes but sharks do not, unless there be prospect of a feast after the battle.

Even a ewe will fight for her offspring, but I have never heard of such action by a female shark. When her pups are born she is done with them.

In the study of animals, or even of fishes, a man usually finds something likable about them, but in the monstrous, cruel, cowardly shark he can find not one admirable trait—he is simply a tiger.

The white fishermen of the "Eastern Shore" detest sharks because of the loss they suffer from them, but, to this detestation, the colored population add a superstitious dread. Of the colored men about my father's place, Silas, alone, was ever ready to go fishing with me and I always wanted him because he saved me the labor of stepping masts and hoisting anchor. One day we took with us Tom, a young man who affected to share the contempt which Silas had for sharks, and who kept repeating Silas' slogan: "Dey kaint hurt yer in de boat."

We were soon hung onto a big shark which they were hauling in while I, at the tiller, maneuvered the skiff to give them slack. In the process of these operations, the shark swished the rope across the stern, and, catching Tom's leg, threw him overboard. He could swim, and all he had to do was to get hold of the rope and haul aboard by it but the idea of a shark at the other end of that rope, fifty yards away, was so horrible that Tom was deprived of reason and, his eyes rolling white while the tide took him back, he simply howled: "Bring dat boat! Oh Lord, get dat shark outen here! Oh Lord, take dat shark away!"

When we finally hauled Tom (and the shark) aboard, Tom was given the honor of being allowed to bash in the shark's head with a hatchet. At the first wallop, the shark opened and snapped his jaws.

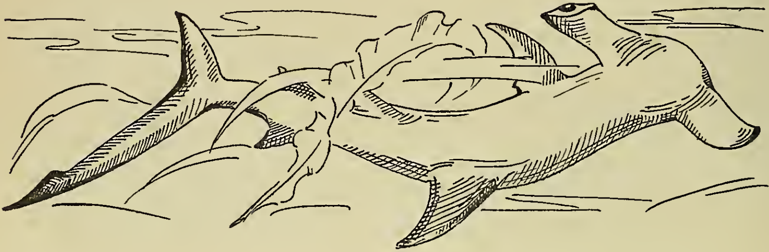
"Shut yer mouf, Shark!" yelled Tom, with another wallop, "I'se seed all I wants ter see of dem teeths—an' I'se done felt 'em too—tearin' through my gizzard when I was back thar in de water wid yer!"

The shark's tenacity of life is amazing. He seems to be immune to nervous shock, cruel wounds affect him only slightly, and he remains dangerous a long time out of water. I have seen a shark, whose liver had been removed for chum, swim strongly away and I once saw a boatman knocked over the gunwale by a shark which had been in the boat nearly an hour.

In the next month's NATURAL HISTORY *Colonel Wise will narrate a number of exciting encounters he has had with sharks off the eastern coast of the United States while perfecting the rod-and-reel methods of which he is chiefly the originator.*

HAMMERHEAD SHARK

Drawn by Else Bostelmann



Tigers of the Sea

(*Photograph by James Thompson from Globe*)

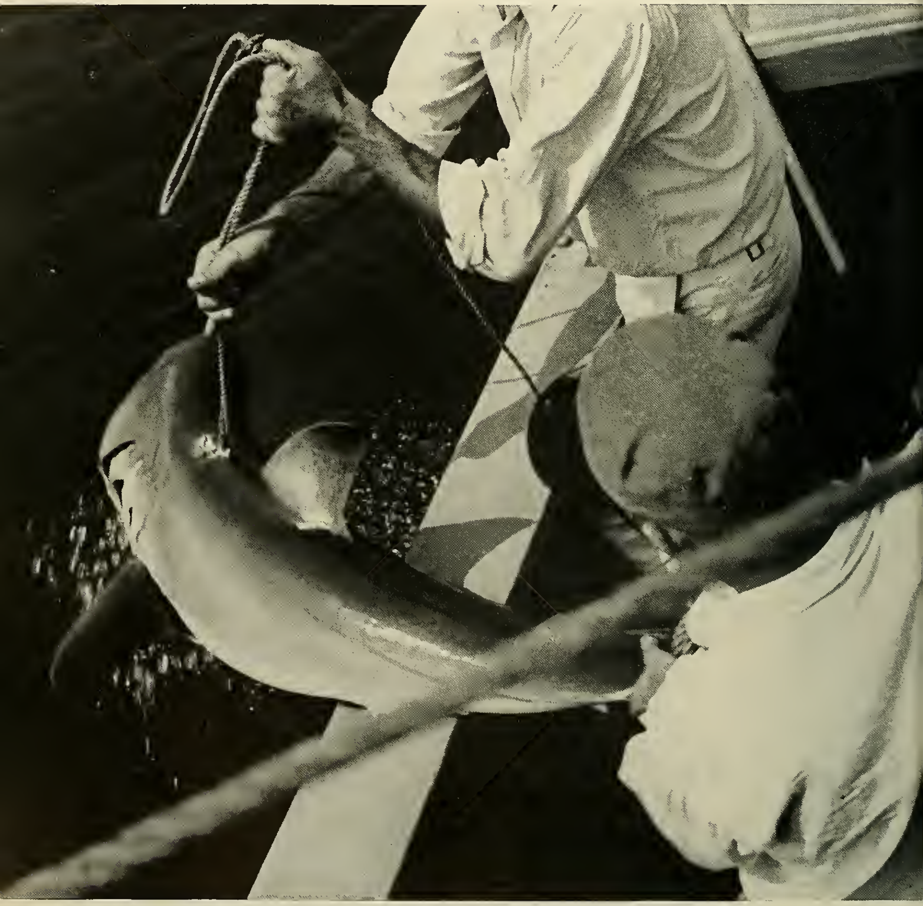
The shark has recently become of commercial value, and companies are profitably fishing for him. Their catches are measured by tons, and practically all of the fish is utilized. Large nets are generally used, but in the above photograph we see a Mako Shark about to be harpooned after a two-hour battle with hook and line

Shark fishermen hauling in a Nurse Shark to be converted into shoe leather. Formerly, shark hide or "shagreen" was used mainly as an abrasive, like sandpaper, and for covering tool handles. Recently a process for removing the rough denticles of the skin has made it possible to convert shark skin into a beautiful and serviceable leather, called galuchat

(*Globe Photo*)

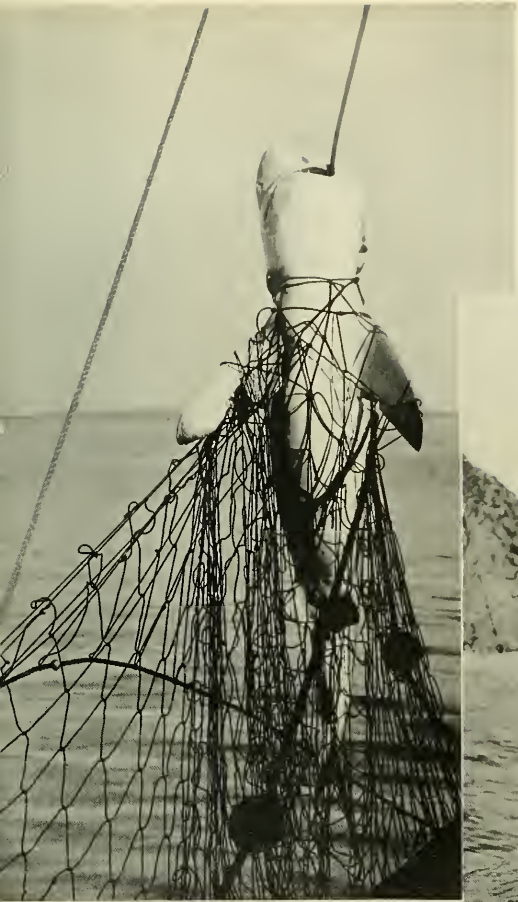
Snapping jaws and thrashing tail make the task of landing a shark dangerous. A harpoon or swordfish dart is generally driven into the fish when it is brought alongside, but it is well-nigh impossible to judge when he is dead. The author of the accompanying article has seen a shark whose liver had been removed swim strongly away, and on one occasion a shark which had been in the boat nearly an hour knocked a boatman over the gunwale

(Photo by Rudolph H. Hoffman, from Black Star)



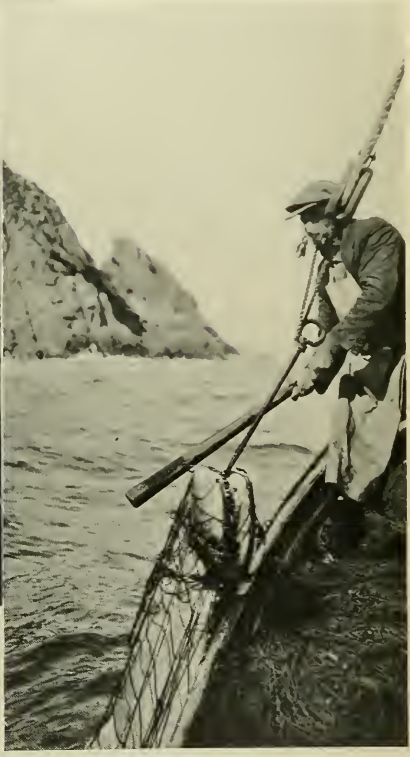
(Below) At the rail a death-blow is easily delivered on the snout, where the shark's brain lies close to the surface.

(Mondiale from Black Star)



(Mondiale from Black Star)

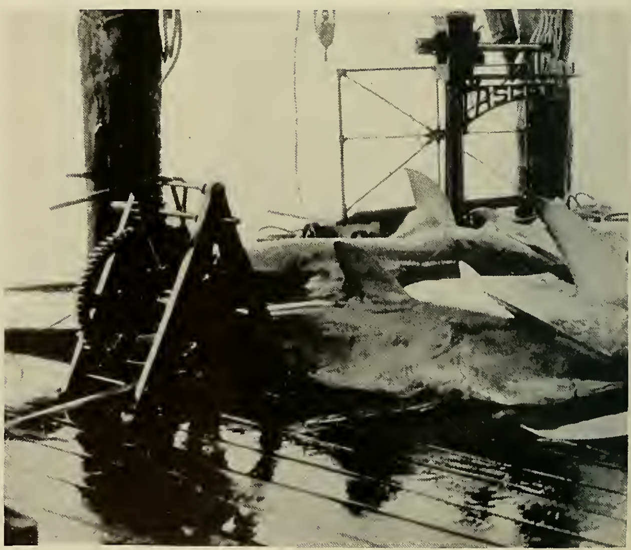
(Above) The shark runs his head through the net and in threshing about entangles his fins. At the surface a large iron hook is fastened through his jaws and he is then hauled out with a derrick



Courtesy of E. M. Scheutz

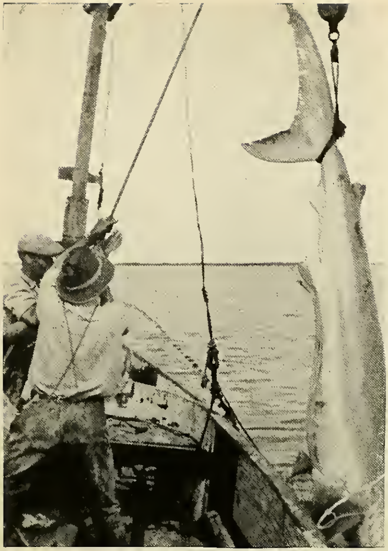
(Above) Tons of Tiger Sharks: a haul of the National Fisheries Corporation ready for processing

The liver of a six-foot shark will yield four gallons of oil, useful in tempering steel, in making paint, and in many other



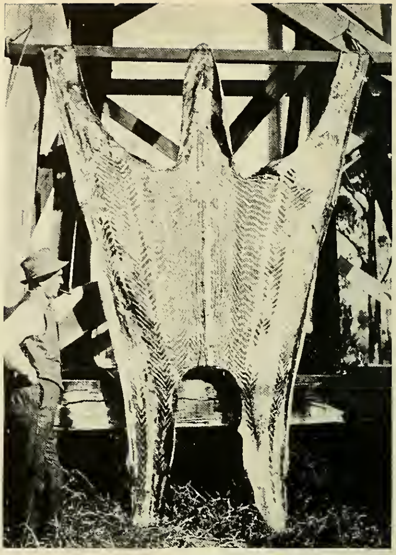
Courtesy of E. M. Scheutz

commercial ways. Medicinally, shark liver oil possesses vitamines which make it a rival of cod liver oil
(Below) A 24-hour catch of Tiger and other sharks off the Australian coast *(Mondiale from Black Star)*



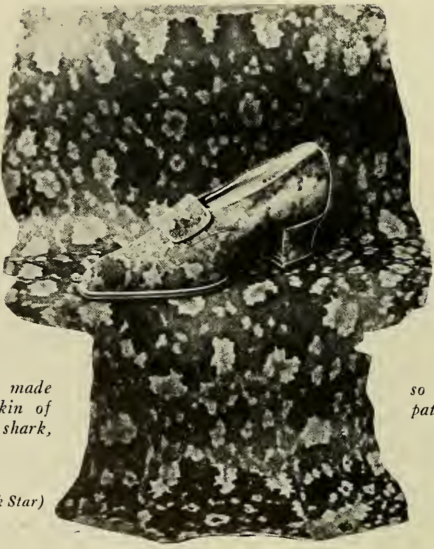
(Courtesy of E. M. Scheutz)

A big Tiger. This fellow will provide leather for shoes, bags, belts, and pocketbooks; ten gallons of oil and lots of shark fin soup



(Mondiale from Black Star)

Tanned hide of a shark: 42 square feet of leather. Before the denticles are removed the "shagreen" is useful for sanding and cleaning decks



Leather and shoe made from the tanned skin of the smaller carpet shark, so called because of the pattern

(Mondiale from Black Star)

Ice from the Thunderclouds

Hail—A $200,000,000 yearly menace; its cause and attempted prevention; record hailstones and hailstorms that changed the course of history

By CHARLES FITZHUGH TALMAN
Late Meteorological Consultant, U. S. Weather Bureau

WHEN a record of weather occurrences tells us that hail has fallen, the statement may seem definite to the layman but often raises a question in the mind of the meteorologist. For centuries people talked and wrote about hail before it occurred to men of science to inquire whether one and the same thing was always described under this name.

What is hail?

There are at least three different kinds of icy lumps and pellets that fall from the sky, and they have all been called hail. What science now regards as true hail occurs only in connection with thunderstorms, either incipient or fully developed, and therefore chiefly in warm weather. It often falls in tornadoes, but probably only when these occur in a thunderstorm area. Hail, as thus distinguished, consists of balls or irregular lumps, each of which, on examination, is usually found to have an opaque snow-like center, surrounded by ice, which is often in alternately clear and opaque layers.

The second class of icy particles takes the form of miniature snowballs, about the size of large shot or small peas. It falls in cold weather, often in conjunction with ordinary snow. Because it readily crumbles, English-speaking meteorologists have commonly called it "soft hail"; but this term is now giving way to the Germain name "graupel."

Lastly, little pellets or angular particles of clear ice sometimes fall in cold weather. These frozen drops, though fairly common, have, until recently, enjoyed the distinction of being anonymous, so far as the scientific world was concerned. In the year 1916, the United States Weather Bureau took the bull by the horns and decreed that such ice particles should be called "sleet"—a word, alas! of many meanings.

A clue to the origin of hail is furnished by the appearance of the typical hailstone. The successive layers of clear and snowy ice are evidently acquired in the course of several journeys up and down, between relatively cold and relatively warm regions of the atmosphere, before the stone finally falls to earth. At high levels the incipient hailstone is coated with snow, and at lower levels with rain, which turns to ice as the stone is again carried aloft. Probably the only place where such a process could occur is in the turbulent uprush of air at the front of a thunderstorm, consisting, as it does, of blasts violent enough to drive a heavy hailstone upward, alternating with lulls that would permit it to fall.

Red hail

Most hailstones are approximately spherical or somewhat conical, but other and very striking shapes are sometimes found. Occasionally the surface is encrusted with curious crystalline growths. Red hail is not unknown. As in many cases of red rain and snow, the color is due to fine dust in the atmosphere, generally blown up from deserts.

Many descriptions of hailstorms tell of a roaring or rattling sound heard during the approach of the storm and apparently coming from the clouds. Some writers compare it to that of heavy vehicles passing over a road or the clatter of many horses' hoofs. Typical of the accounts of it found in the older works on meteorology is the following from a once standard treatise by Professor Loomis:

"Some seconds before the fall of hail, and occasionally several minutes, a peculiar crackling noise is heard in the air. It has been compared to the noise of walnuts violently shaken up in a bag. This noise has been ascribed to the great velocity with which the hailstones are driven through the air, while some have ascribed it to feeble electrical discharges from one hailstone to another."

The noise has not been the subject of much critical investigation, but the best guess as to its origin is probably that offered as long ago as the year 1885 by the French meteorologist, J. N. Plumandon. According to this authority it does not come from the air or the clouds, but is merely the combined sound of many hailstones falling on leaves, roofs and the like at some distance from the observer. When the storm is actually at hand, the observer hears the patter of individual stones in place of the mingled noises of a great number.

Big tales of big hailstorms

India is the home of big hailstorms and of big tales concerning them. Many of these storms have cost from half a dozen to a dozen human lives, one is supposed to have killed 84 people, and another is known to have killed three times that number. It appears, also, that Indian hailstones assume remarkable sizes, but it is not necessary to take too seriously the records of four cases that Dr. George Buist, F.R.S., reported to the British Association in 1855.

"One," he says, "near Seringapatam, in the end of the eighteenth century, is said to have been the size of an elephant. It took three days to melt. In 1826 a mass of ice nearly a cubic yard in size fell in Khandesh. In April, 1838, a mass of hailstones, 20 feet in its largest diameter, fell at Dharwar. On May 22, 1838, after a violent hailstorm 80 miles south of Bangalore, an immense block of ice consisting of hailstones cemented together was found in a dry well."

Dr. Buist recognized the fact that in all four of these cases the icy masses must have been aggregations of numerous hailstones frozen together, but he seems to have believed that in some cases the coalescence of the stones might have occurred in the midst of a vortex or whirlwind before the hailstones reached the ground. This idea can hardly be entertained at the present time. It is safe to say that, if blocks of ice of the sizes reported were actually found after hailstorms, they were formed by the freezing together of hailstones lying closely packed together on the earth.

Nearly all records of exceptionally big hailstones are vitiated by some degree of uncertainty as to whether the reported masses of ice fell as such or were formed by coalescence after falling. So far as I am aware, the biggest credibly reported object that, from its appearance and the circumstances of its fall, may be safely assumed to have been a single hailstone was one that fell through the tile roof of a house in the village of Heidgraben, Germany, August 19, 1925. The stone was picked up on the floor of the upper story and measured, and the dimensions were found to be 9.8 x 5.5 x 4.7 inches. Unfortunately it was not weighed. If it had consisted entirely of ordinary ice its weight would have been about 4½ pounds, but a hailstone is composed partly of snow-like ice, containing much imprisoned air, so that it is less dense than pure ice and the actual weight must have been considerably less than this.

Pound and a half stone

The biggest hailstone thus far on record for the United States fell at Potter, Cheyenne County, Nebraska, July 6, 1928. It was approximately spherical, and when broken open was found to consist of concentric layers of alternately clear and snowy ice around a common center, showing that it was a single stone. It was 17 inches in circumference and weighed a pound and a half.

Since, as I have stated, a hailstone grows gradually in the air in the course of its upward and downward journeys, the size it eventually attains depends upon its density, its shape and the strength of the vertical air current that supports it just before it falls to earth. Judging from the meager data we possess concerning the maximum violence of thunderstorm updrafts, it would seem that something less than five pounds is the extreme possible weight of a hailstone, while a two-pound hailstone would deserve a place in a museum if it could be preserved there.

There is a proverb in eastern Europe that says: "Hail brings not hunger." This refers to the fact that although, where hail falls, the crops may be annihilated, the damage is never so widespread as to cause a general famine. A hailstorm is always confined to a relatively small area—much smaller than that of the thunderstorm of which it is an episode—though its narrow track may be scores or even hundreds of miles in length. Thus it happens that although a great many destructive hailstorms occur every year, the majority of human beings never experience one in the course of their lives.

Another result of the sporadic and local character of hailstorms is that, though statistics of hail occurrence are collected in most civilized countries, many of these storms fail to be recorded. In the United States the Weather Bureau collects reports of hailstorms from something like 5,000 observers and obtains many additional reports from press dispatches, which are carefully checked up at the various "section centers," where climatological data are assembled.

Damage from hailstorms

The Bureau has averaged the data of damaging hailstorms and published it in chart form. In this chart the country is divided into equal sections 100 miles square (area 10,000 square miles), and figures show the average annual frequency of damaging hailstorms within each of these sections.

The largest figures, showing from two to between four and five storms a year, are found in an irregular belt that includes Kansas, Iowa and parts of Indiana, Ohio and southern Michigan, while in much of the Southwest the average annual frequency is recorded as zero, though there are only minor areas in which no damaging hailstorm was observed during the entire twelve years. There is no place in the United States at which the average interval between damaging hailstorms does not amount to several years.

According to an estimate that has become rooted in statistical literature, though it is probably much too small, hail causes throughout the world losses averaging about $200,000,000 a year. In the United States an estimate by V. N. Valgren, of the Department of Agriculture, based upon an 11-year record, indicates that the losses on ten leading agricultural crops of this country—viz., wheat, corn, oats, barley, flaxseed, rice, potatoes, tobacco, hay and cotton—average $47,500,000 a year. In 1915 the losses on these crops totaled $69,000,000. The same authority estimates that hail damage to crops and property of all kinds in the United States amounts, on an average, to at least $75,000,000 a year.

A $5,000,000 hailstorm

In 1928 there were two hailstorms in the State of Kansas that injured crops to the extent of $3,000,000 each, and on August 18, 1925, a single hailstorm is supposed to have cost the farmers of Iowa about $5,000,000, besides doing damage to the extent of $500,000 in the adjacent State of Illinois. No part of the country east of the Rockies is exempt from these disasters, and they occur occasionally even in the Far West. Fresno, California, had a $50,000 hailstorm on October 5, 1925. What ruin hail can accomplish in New England is illustrated by the million-dollar hailstorm in the tobacco-growing region of Connecticut on August 1, 1929.

That hail can work huge havoc in a city as well as in the country was shown in the case of the famous Dallas, Tex., hailstorm of May 8, 1926—the most destructive that has occurred thus far in any of our cities. The total damage in and about Dallas was estimated at $2,000,000, and the brunt of the destruction was experienced in the business center of the town. Here the hailstones in many cases were three inches in diameter. Tons of ice fell on streets and buildings during a period of fifteen minutes. Not only were thousands of windows and skylights broken, but roofs of all kinds were wrecked to such an extent that the Mayor issued a proclamation authorizing owners to make needed repairs without first getting the usual building permits. Street lights and electric signs were shattered, and there was the usual riddling of greenhouses. The distinctly modern note of the disaster was the immense amount of damage done to automobiles, estimated at more than $100,000.

How the ancient Greeks attempted to keep hailstorms from devastating their crops and vineyards is told in Seneca's "Quæstiones Naturales." The town of Cleonae, in Argolis, he says, employed watchmen to give warning of the approach of hail clouds, which were recognized by their color. When the alarm was sounded people sacrificed a lamb or a pullet;

whereupon, it was alleged, the threatening clouds changed their course. Those who had no animals to sacrifice scratched their fingers with a sharp stylus, and this was supposed to be equally efficacious—as it undoubtedly was!

In the days of Charlemagne European peasants set up tall poles in their fields bearing at the top strips of parchment inscribed with incantations against hail.

Various charms are still employed in rural Italy to avert hailstorms. Professer Giuseppe Bellucci tells us how, in Umbria, the peasants on Palm Sunday attach to the tops of trees adjacent to their fields consecrated olive branches or bits of charred wood from the Yule log. In some districts they spread ashes from the Yule log tree on the fields in the shape of a cross, or hang amulets and religious emblems of various kinds on the trees, or ring little silver bells—all to keep away hailstorms.

Quaint machines to prevent hail

In the early years of the present century much was heard about two contrivances widely employed in Europe, especially by vine-growers, for the purpose of preventing the destructive effects of hail. One was the hail-rod; known in France as the "electric Niagara." This was merely an extra large and lofty lightning-rod. It was supposed to draw off electricity from the storm clouds and thereby—though nobody ever explained why—to prevent hail from falling in its vicinity, or to render it soft and harmless when it fell. Many hail-rods were erected in France under government auspices, but they now appear to be completely neglected and forgotten—as they deserve to be. They were perfectly useless.

The other equally futile device was the hail-cannon; a special form of mortar, which discharged a whirling ring of smoke and gas but no solid projectile. Thousands of these cannon were used in Austria, Italy, France and elsewhere. They are now nearly obsolete, but they have been replaced in many regions by the hail-rocket, which bursts high in the air and hence is alleged (especially by its manufacturers!) to concentrate its effects where they will do the most good. The truth is, however, that the rocket bursts far below the level where hail is formed, and that, no matter where it burst, it could not conceivably affect the formation or the fall of hail.

Still another delusive contrivance is the hail-kite, invented in Russia. This is really an assemblage of box-kites, carrying sirens, which are operated electrically from the ground end of the kite wire. They emit a loud continuous note, and the resulting vibration of the air is supposed, in some miraculous way, to nip the hailstorm in the bud.

A storm that changed a king's mind

A hailstorm that played an important part in history occurred in April, 1360. The English had long been at war with the French. Edward III, after an unsuccessful attempt to take Paris, had withdrawn his army toward Chartres. The French offered to negotiate peace, but the English king was stubborn. Then came the storm, which is thus described by Froissart:

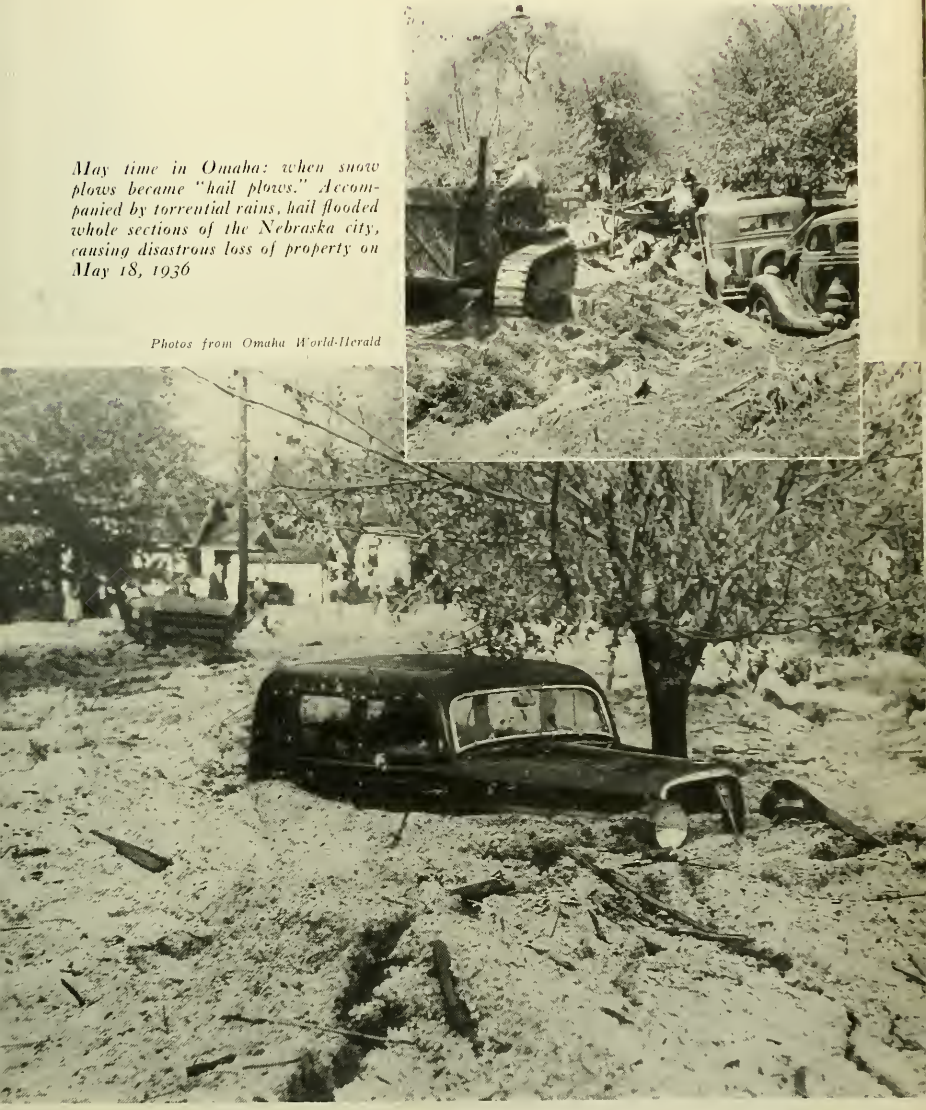
"During the time that the French commissioners were passing backwards and forwards from the king to his council and unable to obtain any favorable answer to their efforts, there happened such a storm and violent tempest of thunder and hail, which fell on the English army, that it seemed as if the world were come to an end. The hailstones were so large as to kill men and beasts, and the boldest were frightened. The king turned himself toward the church of Our Lady at Chartres, and religiously vowed to the Virgin, as he has since confessed, that he would accept terms of peace." The result was the Treaty of Brétigny.

The chronicles of the time place the English losses from this storm at 1,000 men and 6,000 horses; probably an exaggeration.

Another hailstorm that lives in history is the one that happened in Europe on July 13, 1788. Beginning in the center of France in the early morning, it passed northward in two parallel bands, about twelve miles apart, crossed Belgium, and finally died out in Holland in the afternoon. The western band was about ten miles wide and 420 miles long; the eastern, five miles wide and nearly 500 miles long. Profound darkness preceded the passage of the storm. The hail lasted only seven or eight minutes at any one place.

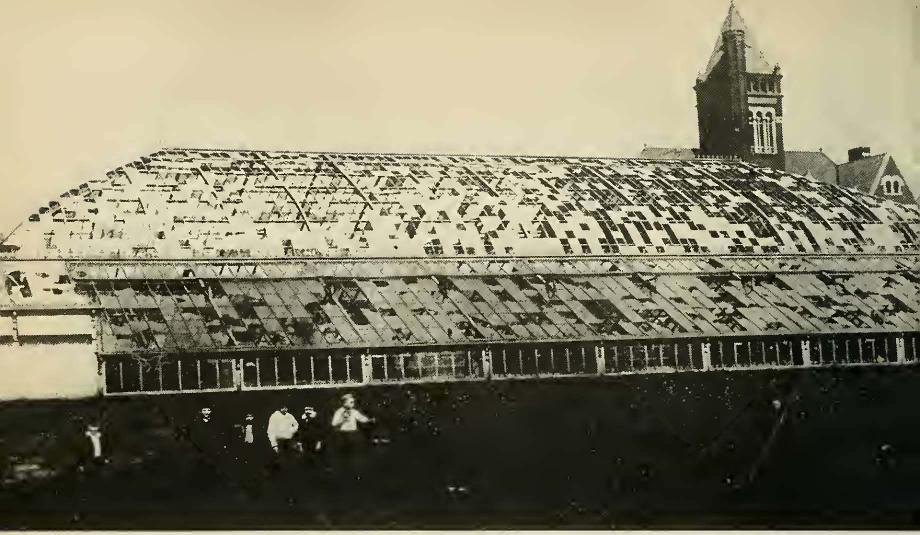
No less than 1309 communes in France suffered from this visitation, and the total loss was nearly $5,000,000. It is said that the distress occasioned by the storm hastened the outbreak of the French Revolution.

Ice from the Thunderclouds



May time in Omaha: when snow plows became "hail plows." Accompanied by torrential rains, hail flooded whole sections of the Nebraska city, causing disastrous loss of property on May 18, 1936

Photos from Omaha World-Herald



C. F. Talman, U. S. Weather Bureau, Washington, D. C.

(Above) Greenhouse glass pays huge yearly toll to hail: this Pittsburgh storm smashed tens of thousands of dollars in window panes

(Below) Devastation in an orchard: the whole top is battered off this Leesburg, Virginia apple tree

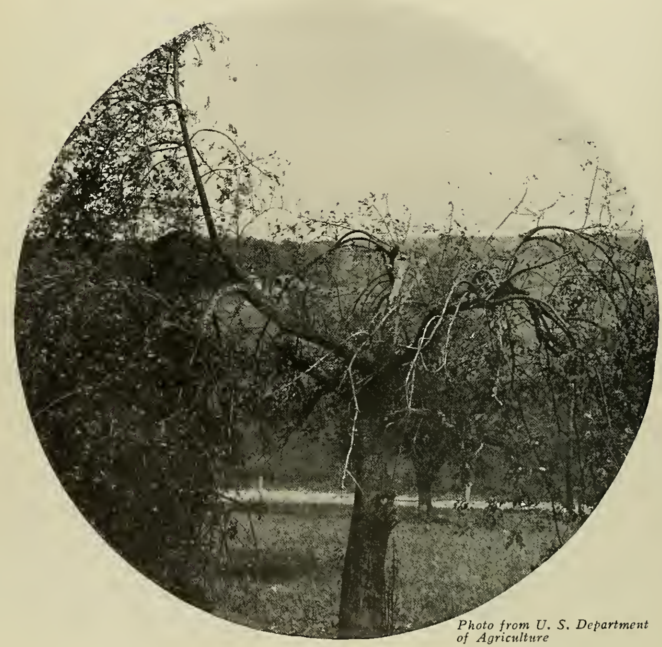


Photo from U. S. Department of Agriculture

Photo U. S. Geological Survey

(Above) Shell holes of the frozen blast: impressions of hailstones in soft mud. Similar prints formed in bygone geological ages are today preserved where mud has become stone (Below) Icy "boll weevil": hail-ruined cotton plants stripped of their leaves

C. F. Talman, U. S. Weather Bureau, Washington, D. C.

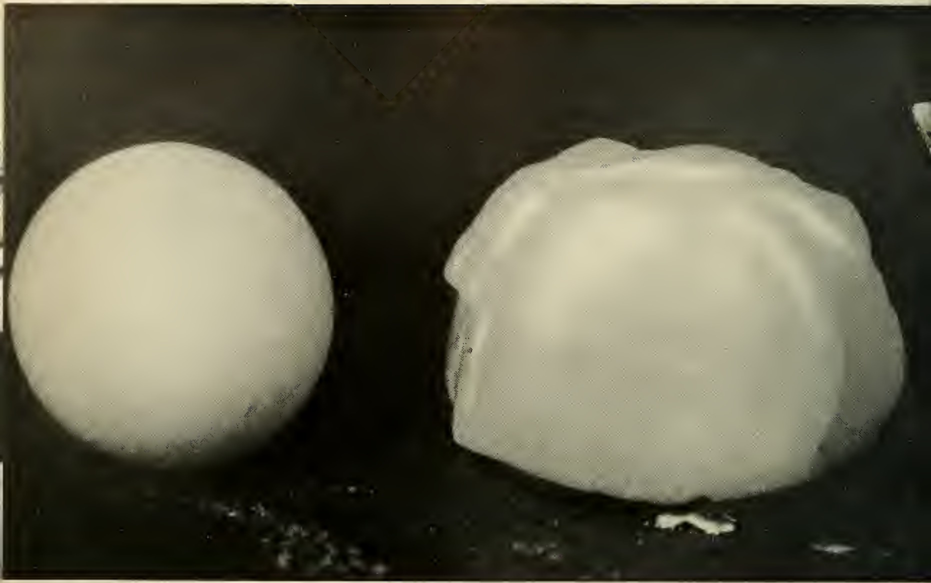


Photo Lynn Acutt, Durban, South Africa

(Above) Big as a tennis ball: actual specimen of the hail that fell at Durban, South Africa, June 24, 1929, compared to a standard tennis ball. Storm-damage estimated at £750,000

(Right) Hailstones laugh at shingles: a typical scene after the great Dallas, Texas hailstorm of May 8, 1926

C. F. Talman, U. S. Weather Bureau, Washington, D. C.

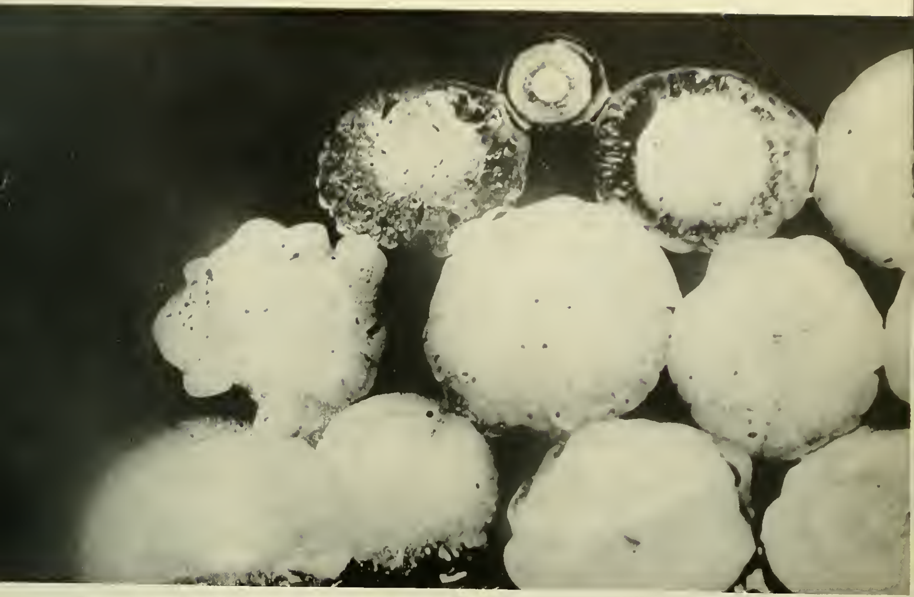
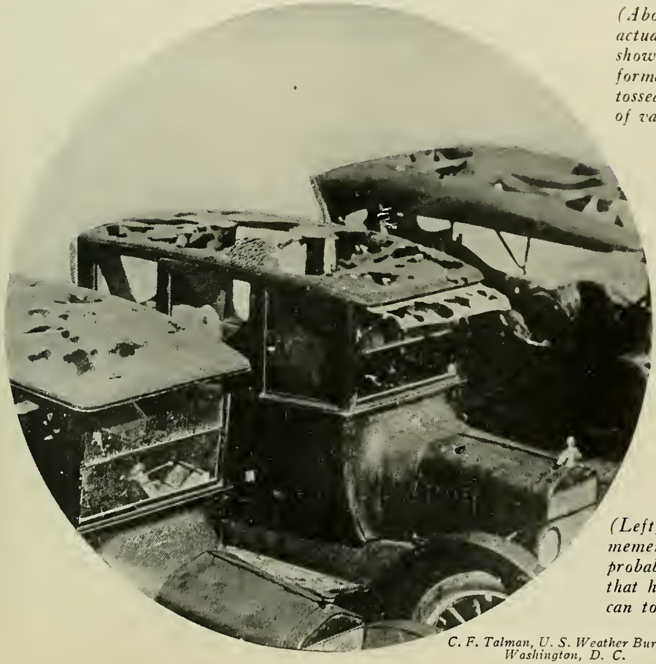


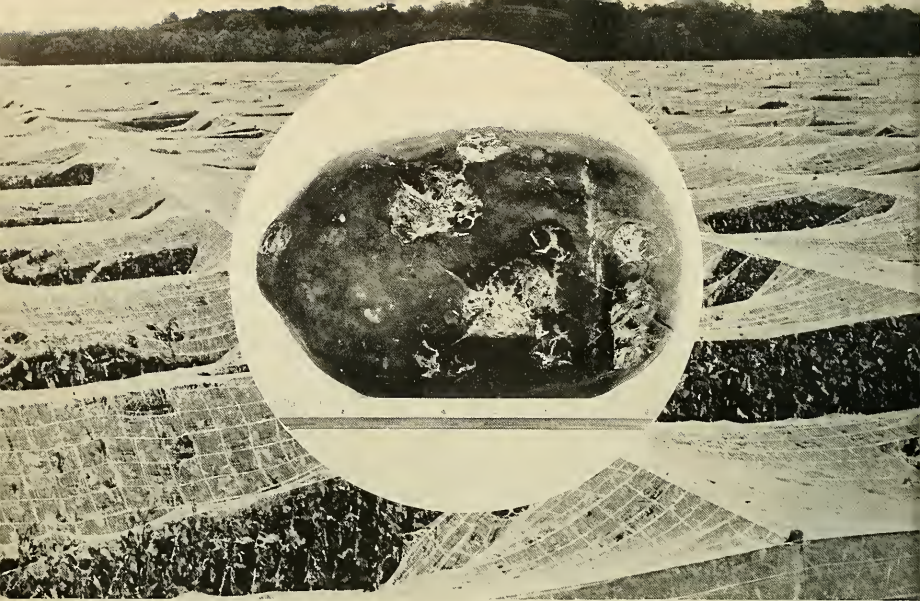
Photo by H. Metcalfe

(Above) Bullets from the sky: actual size photos of hailstones showing their onion-like layers, a formation produced as they are tossed through different air strata of varying temperature



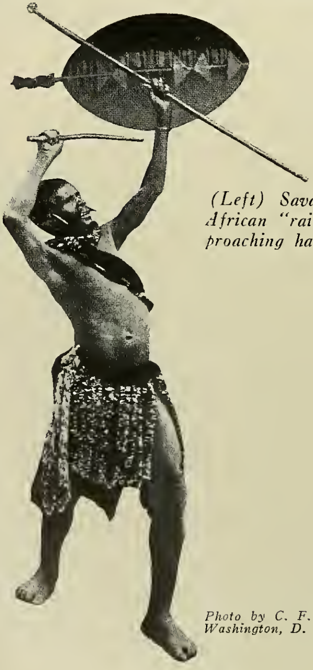
(Left) Riddled automobile roofs: mementos of the Dallas storm, probably the most destructive that has ever ravaged an American town

C. F. Talman, U. S. Weather Bureau,
Washington, D. C.



C. F. Talman, U. S. Weather Bureau, Washington, D. C.

(Insert) What hailstones did to a watermelon. (Background) A futile attempt to "bomb-proof" a Connecticut tobacco field: loosely woven canvas ripped by the devastating pellets



(Left) Savage versus hail: A south African "rain doctor" fighting an approaching hailstorm

Photo by C. F. Talman, U. S. Weather Bureau, Washington, D. C.

(Right) When the "hail-shooting" mania was at its height. An exhibition of the hail cannon at Padua, Italy

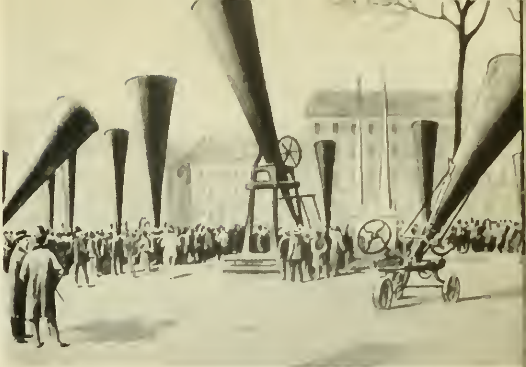
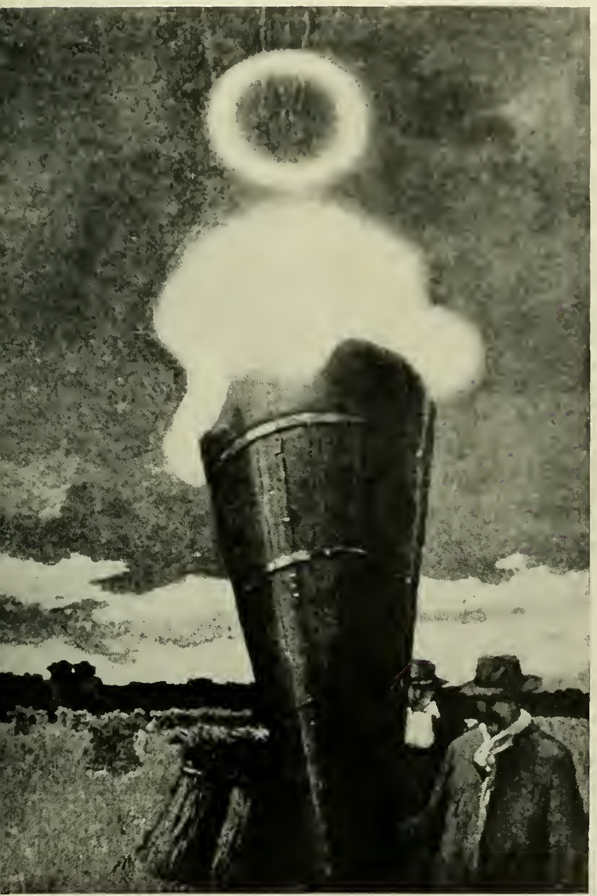
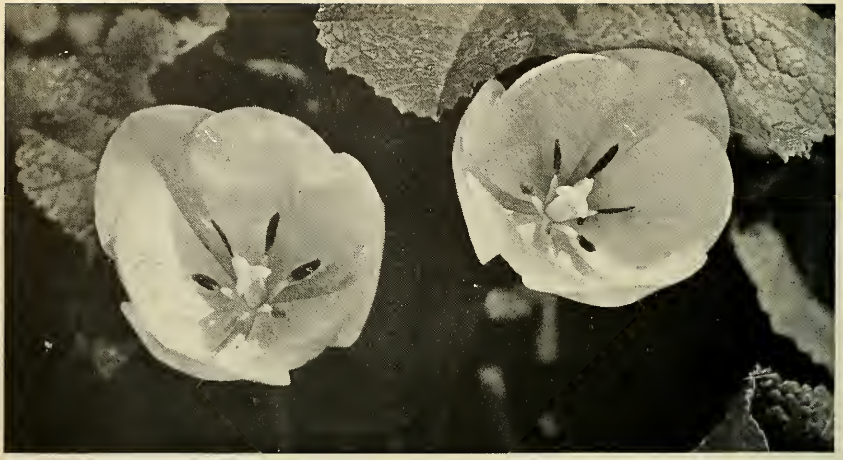


Photo by C. F. Talman, U. S. Weather Bureau, Washington, D. C.



(Left) Man's futile retaliation: cannonading the clouds. A counter-barrage method of "protection" formerly in high favor in the old world. (A painting by Jules Guerin)

Photo courtesy Everybody's Magazine

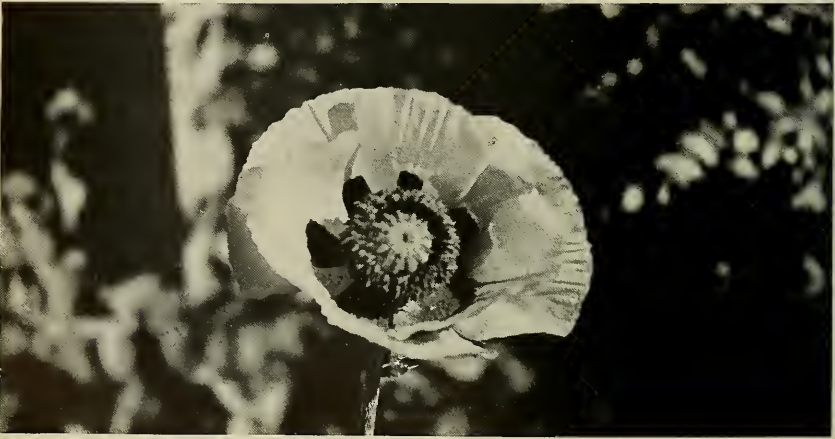


Flowers that "Go to Sleep"

An Unusual Series of Photographs by Frank S. Gehr

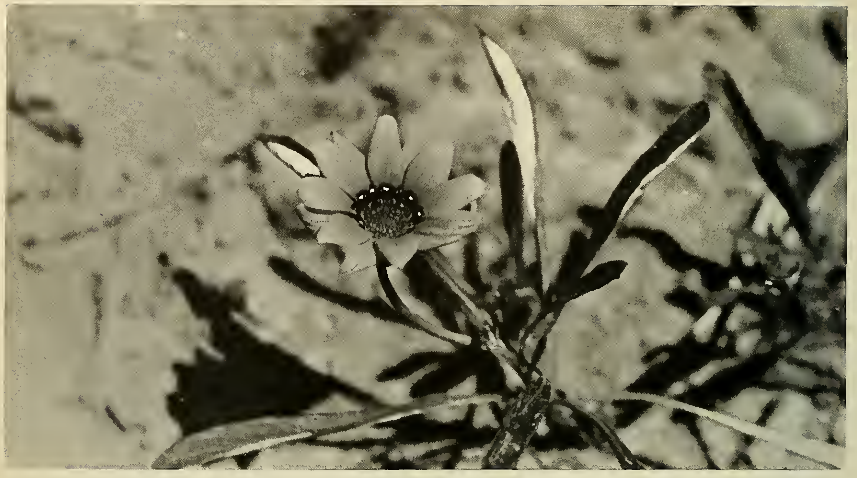
People do not usually realize the extent to which common flowers close at night and open again with daylight. The upper picture shows two yellow tulips as they appeared in the middle of the day; whereas the one opposite it on the right-hand page shows the same flowers closed at night not many hours later

Although temperature and moisture have some effect, sunlight is the most important factor in the strange movements which flowers undergo. The red oriental poppy, illustrated below, is one of the flowers that "go to sleep" when it is dark, as you can see from the photograph opposite taken at night



(Above) A wild morning glory "awake" in the sun
(Opposite) The same flowers "asleep" at night. A number of morning glories only open for one day

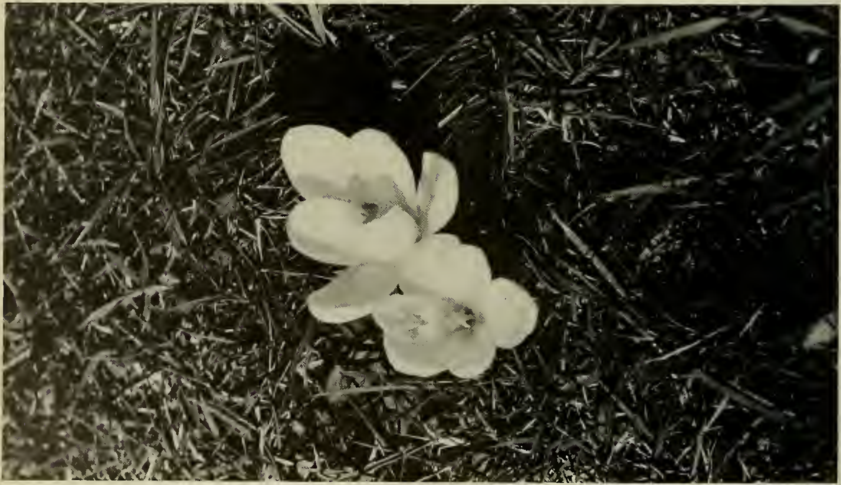
(Below) A fringed gentian in daylight
(Opposite) The same flower as it appears at night or on a dark day. The movements of plants can be stopped by anaesthetics like ethylene, the constituent of illuminating gas, of which only 1 part in 1,000,000 is necessary



The African daisy in the above photograph is open because the sun is shining on it; but when photographed at night by flashlight the flower is seen to have closed completely

(Below) White crocuses in sunlight

(Opposite) At night the photographer finds them "sleeping." There are other flowers, however, which reverse the movements shown in this series, opening at night and remaining shut during the day



José—1936

Further adventures of a little animal whose only friend was man; the coati which won a place on the American Museum's expedition at Barro Colorado

By FRANK M. CHAPMAN
Curator of Birds, American Museum of Natural History

[THE STORY SO FAR: In December, 1934, this racoon-like little animal met and won the friendship of Dr. Frank M. Chapman on Barro Colorado Island, in the Canal Zone. Doctor Chapman created much interest in José among readers of NATURAL HISTORY when he recorded his subsequent relations with this wise and appealing creature in the April, 1935, issue of the magazine. He showed José to possess extraordinary intelligence, expressed chiefly through his remarkable sense of smell.

Like other animals of his kind he lived alone until, prompted by the developments of the annual mating season, he went to the forest to fight for a mate. After an absence of about two weeks he returned from his adventures minus an eye and an upper lip and with various other wounds. Fed by members of the Barro Colorado staff he survived the summer and returned to Doctor Chapman's care the following November.

In the present article Doctor Chapman continues the story of José's life until they again separated in April, 1936.]

AFTER my departure from Barro Colorado in April, 1935, José was adopted by the laboratory family. Possibly it would be more accurate to say that the family was adopted by José. At any rate, seven months later I found him occupying much the same position as a household cat, notoriously a spoiled creature of independent ways.

Bananas, please!

He had established his headquarters at the entrances to the laboratory and kitchen, digging a slight hollow in the earth beneath the water tank in which at times, he rested. From this retreat, when hunger prompted, he issued to hold up whoever chanced to pass for food, meaning always bananas. His request was wordless but made with unmistakable motions as, on his hind legs, he came confidently forward. If no fruit was forthcoming he retired; if it was held beyond his reach; he did not hesitate to climb for it and the marks of his claws on one's legs bore evidence to their sharpness and the strength of their owner's grip. This experiment was not repeated.

Weight no handicap

José had not been able to replace his injured eye, but his upper lip was in large measure restored, leaving a scar visible only to those who looked for it. Of his numerous bodily wounds there was no outward evidence while his general physical condition bespoke leisure, repose, and abundant food. José's figure had indeed lost the slenderness of the wild individuals of his kind. He was, unquestionably fat and showed a marked disposition to sit or lie down when not in motion. I ended this degrading life of luxury by restoring the feeding-tray on the trolley from my balcony to the forest as José's source of food. It was believed by those responsible for José's increase in weight and apparent immobility that his avoirdupois would prevent him from performing the acrobatics which had so distinguished him the preceding spring. They were mistaken.

Finding that his demands for food were no longer honored José soon accepted my invitation to return to the scene of our first meeting. There he found no bananas offered him from indulgent hands but only the scent of bananas proceeding from places beyond his immediate reach. Seven months had passed since he had been confronted by this situation. Would memory assist him in meeting it or would he employ orginal initiative?

The odor of a peeled banana on my balcony rail evidently attracted his attention and, nose up, he "tried the air" in familiar fashion. At once he came to the balcony floor, leaving it and returning several times before he located the food on the rail. This was distinctly below his average performance of the preceding spring. And twice he visited the rail before he discovered a second banana on the crossbar of the three-foot upright to which the feeding-tray trolley wires are attached. This he climbed with some little effort, remaining on it to eat his reward.

He seemed to be aware of still further food in the feeding-tray about eighteen feet distant and started to walk the trolley wires toward it but after one step returned to the cross-piece and descended to the ground. Thirty minutes later he returned without hesitation for a fresh piece of banana on the cross-piece but made no attempt to go to the tray. In another half hour he again came to the cross-piece for the always acceptable banana. As before, he started on the wires for the tray but after a foot gave it up and retreated to the ground. But there was still banana in the air, and with characteristic coati persistence José soon returned to the cross-piece and finding no more banana there turned his whole attention toward the tray, where a lone banana remained. For the first time he now encountered the cord by which the tray was pulled to and fro. It was of the same kind as that used in various banana experiments with him the preceding spring and its touch seemed at once to arouse memories of bananas which had then always been attached to it. At once he pulled it vigorously and, when this brought no result, as before he bit it until I interfered.

This ended the tests for the day. They showed plainly that José was far from losing either his mobility or initiative and that when the right cord was touched his memory was responsive.

Walking the wire

The following morning, November 30, at 10:50, José returned, climbed up the steps of the balcony where I was sitting, and came to me obviously for food. I referred him to the crossbar and tray where bananas awaited him. But for reasons, if any, known only to himself, he descended the two steps to the ground and went directly to the woods thirty feet away. Passing the tree to which the far end of the trolley wires are attached, and which was still encircled by the impassable zinc "rat-guard," he started to climb the following tree but after ascending several feet slipped back to the ground. "Ha ha," I said, "it's too much for you," but without pause he continued to the succeeding tree. Evidently it had required only two or three steps to show him that this second tree was not the right one. But on the third tree he obviously felt at home and confidently climbing to the point where it met the "trolley tree" he crossed over, descended that tree to the wire and without a moment's pause walked out on one wire, resting his tail on the other, to the tray ten feet away. He acted as though wholly accustomed to the maneuver, ate his banana while resting easily on the tray, and then at once retraced his route to the ground. On this, his first trial, therefore, with only the slight, quickly corrected slip of starting up the wrong tree, he remembered his indirect route to the tray and followed it without difficulty. He did not, however, seem to climb as easily as in the preceding spring and, when ascending, stopped three times to rest a few seconds while panting rapidly. But within a few days he was an agile as ever. Why he should have balked at the wires the first day and treated them so familiarly the next I am unable to say. Possibly because at the forest end of the route to the tray they formed a regular part of an unbroken succession of events, while the balcony route was broken by various incidental experiences.

José's rivals

These two days served completely to restore the relations with José which had been broken by my seven months' absence. Meanwhile his existence had become somewhat complicated by the appearance of several rivals for our favor. These animals, known as Miguel, Julio, and Antonio, observing the ease with which José supplemented the food supplied by the forest, had not hesitated to advance their own claims for bananas and each found one or more patrons among the workers on the island. But although these later comers were still fed at the entrances to kitchen and laboratory they did not hesitate to poach on

José's preserves at my balcony. When he was present they did not venture to trespass, for they apparently recognized his seniority, and, in a swinging gallop, always retreated before him. But José sometimes had affairs of his own to attend to and when absent these trespassers soon also learned to reach the various places in which I offered bananas to possible bird visitors.

Within an hour after the feeding-tray had been cleared of the enveloping luxuriant vegetation of the wet season and supplied with a banana, it was visited by doubtless the same tanagers that had frequented it the preceding spring. They were soon joined by two blue tanagers and an adult female and young male of our summer tanager, wintering here. At times all three species were present together, an apparent recognition of family relationships or, at least, an exhibition of similar tastes, which resulted in a singularly beautiful picture. But if I expected to continue to receive these birds as guests I must find some way of protecting their dining-table from an intruder who would not hesitate to make them part of his meal. I therefore returned to the problem of making a coati-proof dining-table for birds. If a tray on two trolley wires could be reached so easily, possibly a tray on a single wire would be beyond a coati's powers. Two wires supplied one for the feet and one for the tail, making a stable means of locomotion. But with the tail support removed, Mr. Coati would find himself strictly without visible means of balance. Moreover, recalling something about the super-skill required to walk a "slack rope," I resolved that as a final deterrent my wire should be of the slackest. So I dropped it nearly four feet in sixteen, or to an angle of about twenty-three degrees, confident that the food-tray was now for flying creatures only, birds by day and bats by night.

With the greatest of ease

But José mastered the new contrivance at the first attempt. It is true his little journey was ended so hastily that the tray turned over with him. But he lost neither his head nor his footing while the banana was grabbed as it swung above him and devoured before he resumed his journey upside down and returned to the tree somewhat winded but experienced. After lunch the journey was repeated with everything under control and it was evident that while I had added to José's skill I had in no way reduced his sources of food. Thereafter, I tried to keep the tray so well supplied that there would be enough bananas for both birds and coatis. But I did not confess myself defeated. I still thought that there must be places open to winged creatures and closed to quadrupeds and I looked to the trees.

Tying a banana at each end of a three or four foot string I tossed them to the outer branches of the trees over my balcony. Some barely caught and hung dripping from the terminal twigs as though they had grown there. Even the tanagers could reach them only while on the wing. And the coatis? I must confess that they made me feel as though I were lacking in both experience and imagination. For them I had merely substituted a banana for an almendro nut. They climbed down the branch as far as possible and if they could reach the string pulled it in with the banana at its end. Just, indeed, as they had pulled in the bananas attached by strings to the feeding-tray. If they could not reach the string they broke off the limb to which, directly or indirectly, it was tied and pulled that in. One pair of bananas landed at the extremity of a far-reaching balsa limb twenty feet above the ground and twice that distance from the trunk of the tree; but they were unerringly located and collected. Not one banana escaped.

Making it more difficult

I deferred making the final experiment that occurred to me. Not because I believed that it, too, would fail, but because of its general inappropriateness. Taking a leaky zinc wash-tub I nailed it upside down on a stout pole about eight feet long, of which two were firmly set in the ground. Bananas were placed on its upturned bottom and there, at least, coatis tried in vain to get them. One after another the younger animals climbed the pole to the heart of the tub and dropped back to earth. But they were far from discouraged, and repeated pawings at the rim of the tub finally so weakened its fastening to the pole that it swung to and fro and a more than usually agile coati succeeded in getting his claw over the rim and, in some inexplicable way, hoisted himself up on to the bottom. In the end, therefore, not even the tub was immune and at this point I abandoned further attempts. The coatis won. The birds must take their chances. I would supply the bananas.

Meanwhile, I found that coatis were not restricted to a fare of bananas. With the ripening of the almendro nuts late in January they ascended the trees that bear them and no nut was too remote to escape picking. Only the thin rather acrid outer covering was eaten, then the nut was dropped for the peccaries, pacas, agoutis, and squirrels. This is a favorite food but even at the height of the almendro season coatis varied their fare. I was seated on my balcony one afternoon early in February when an unrecognized coati started sniffing about on the hillside near me. In a moment he was evidently assured that he had found what he wanted and began to dig. It was not a casual digging. It was a frenzy of digging. The earth, which had been in position only ten years, was comparatively loose and with stones nearly five inches in diameter it rose in a continuous eruptive shower that rumbled down the hill. Within five minutes the animal was lost to view in his own excavation. At the end of that time he withdrew his prize—a tarantula which, barring two claws, was devoured on the spot. The hole was thirty-two inches deep and fourteen inches wide at the entrance.

Fond of eggs

There is a general, and I think, warranted belief that coatis are destructive to birds, their nests and contents, but beyond their capture of a paroquet at the laboratory I know of no instance of their bird-eating. As a means of gaining more information we therefore placed two hens' eggs where they would be seen by wild coatis. Their action was prompt and definite. One egg was soon carried unbroken to a distance of a hundred feet before eating, the other was devoured on the spot. The top was neatly removed from each egg and the exposed contents then lapped up as though from an egg cup. One could imagine that such skill could be acquired only by experience, perhaps with tinamous' eggs.

To vary this test I hid two eggs at different spots in the grass on the hillside near my balcony. One egg was not handled and was placed with the aid of a tablespoon attached to a long pole. It was never visited. The other was hidden by hand and visited frequently. Neither egg was taken and the experiment is mentioned only to suggest that it be repeated.

That an animal so fond of bananas should also have a pronounced if not indeed passionate liking for tarantulas helps prepare us for the statement that coatis are also fond of bats!

When at night I explored the forest from my balcony with a powerful searchlight, its rays were often thronged by bats of several species. Some were fruit-eaters and in a steady line came for a bite of the banana in my food-tray. Others appeared to be insect-eaters, darting erratically here and there. To capture specimens for identification, like a great spider I spun my web, in the form of an Italian bird net, thirty feet long and six feet wide, between me and the forest. The bats caught were presumably fruit-eaters, which apparently lack the sensitiveness that aids insect-eating bats to avoid objects when in flight. But if they became entangled in a part of the net within reach of tree or hillside only the wings were left for me while a coati appropriated the still living body. I therefore abandoned this form of collecting and restricted further experiments on the food of coatis to cake and candy, both of which they refused. Of bananas, however, they never tired and even the ripest specimen was acceptable.

While José seemed in perfect physical condition it is clear that at the end of January, 1936, as the annual mating season approached, he was not as well prepared for its tests as he had been the year before. He was much overweight, a diet of bananas was doubtless not as strengthening as one more varied and more difficult of acquisition, and he was minus the eye lost in last year's mating contests. Consequently, if there is any truth in the theory that an animal physically below par is seriously handicapped in the struggle for existence, José entered the lists of the 1936 mating season under a marked disadvantage.

José's marital expedition

The result supported the theory. The date of his return from his marital expedition demonstrated the regularity of his physiological cycle. It will be recalled that in 1935, after an absence of two weeks, he returned to the laboratory on February 11. In 1936, after a somewhat briefer absence, he returned on February 10. In 1935 he was minus an eye and an upper lip and plus countless body wounds, some of major importance. In 1936 he had lost the use of a foot, the remaining eye was badly injured, a former shoulder wound was reopened to a length of about four inches and width of over one, and there was literally not two square inches of his body that did not show the mark of claw or tooth. José was, indeed, such a pitiable looking object that the men urged me to end his suffering. The injury to his foot was the most serious. It robbed him not only of an organ of locomotion and means of securing food, but of a weapon. The foot was swollen, its claws bent backward, and the care with which it was held from the ground indicated that it was painful. Above all, José's spirit seemed broken. He had lost his distinguishing confident attitude toward life, and after eating three bananas hobbled back to the woods, his lowered tail, like a flag at half-mast, dragging behind him.

His spirit broken

The preceding year, after returning from his campaign of conquest, José had to contend only with his wounds. We supplied him with food and in the vicinity of the laboratory he found safety from his enemies. Meanwhile other coatis of his sex have made friends with us if they have not with him. If earlier in the year they interfered with what he evidently considered his prior rights, he exhibited his authority in a manner not designed to promote his popularity. Now it was their turn and they knew it; so did he. When in the morning he returned for his daily bananas he moved cautiously, advancing only after careful inspection of the surrounding territory. Even when eating he was constantly on the alert and would suddenly stiffen to attention if he fancied he detected the presence of an enemy. This act always impressed me as an exhibition of intelligent discrimination. Did he or did he not hear or smell one of his own kind?, it seemed to say. If he concluded that he did not, he resumed eating, but if he became convinced that an enemy was nearby, the half-eaten banana was dropped abruptly. There was no questioning growl, no "trying of the air" with that sinuous nose, no querulous twisting of the snake-like tail; without a word or a moment's pause, tail dragging, he loped away in complete and shameless confession of his impotence.

But notwithstanding his evident desire to avoid further conflict, at least until he was better prepared to defend himself, it was apparent that he did not always escape. Often he showed new and more or less serious wounds and it was a question whether in spite of our care he would survive the attack of his foes. They showed him no mercy and about the laboratory, at least, appeared to be almost constantly on his heels. He could find no place where he was secure. March 3, for example, after eating four bananas on my doorstep he entered and crossed my room as though he were considering it for a retreat. But something, perhaps the confinement of four walls, evidently worried him. I stood one side to let him choose his own resting-place but he seemed in constant fear of an assault from the rear and returned to the door. Crossing the balcony to descend the steps he stopped suddenly head down, body trembling, as though about to collapse. Twenty feet away a coati was coming slowly toward him. José made no attempt to escape. He seemed to be ready to surrender. The approaching animal was one of the younger ones that he had dominated earlier in the season. José, I felt, would be helpless in his claws, so I drove him back to the forest and tried to induce José to return to my room. But this was a form of retreat he did not understand. So he pulled himself together, went down the steps and slowly climbed the hill away from his enemy.

A fierce encounter

Three days later an animal that I recognized as Miguel, after I had driven him off several times, charged José while I was feeding him at the laboratory door. The attack was made from the rear with a sudden, deadly ferocity and José responded with a power and drive that we had not supposed remained in his torn body. Miguel, evidently as much surprised as we were, quickly gave way and we completed his rout. Then to illustrate that such little incidents are all part of a coati's daily life, José, with complete composure, returned to the banana he was eating from my hand. I showed far more excitement than he did.

Meanwhile José was making a marvelous recovery from his countless wounds. What is it, one asks, that keeps his scratches, cuts and gashes free from infection? Certainly the tongue, with which alone they are washed, bears no visible healing ointment but carries the essence of one wound to another, and all alike are without traces of pus or inflammation. How places beyond the reach of his tongue were treated I do not know.* His foot alone seemed inflamed and sore but here there had been an apparent tearing of ligaments which called for replacement of claws, and possibly bones, before healing, and while progress was made it was slow. It was not until March 11 that I saw him attempt to use his injured foot, other than to walk on it. Then he dropped a banana half-eaten and sniffing along the hillside made a half-hearted attempt to unearth a tarantula. The act seemed to say "I'm tired of bananas; give me some real coati food."

During this period of daily visits José and I established closer relations than had previously existed between us. Hitherto I had been merely a source of bananas of which my hand was the container. Now he acted as though there was something in our relations besides bananas. He recognized my voice and responded to his name, coming to me, when hungry, from distances up to a hundred feet. He acted as though at home in my study where, his hunger appeased, he spent hours, chin on paws, comfortably sleeping in evident belief that he was safe there. Thus he clearly looked to me for protection as well as for food.

José's trust

When feeding he no longer grabbed the banana from my hand and made off with it but gently put his paws on mine and with apparent care to avoid injuring me with either claws or teeth, ate slowly. In short, within limitations, José and I had acquired confidence in one another. Knowing that since he had left his mother's side he had never been touched except with intent to kill, I made no attempt to caress José, nor did I expect anything like a purr or friendly tail-wag from him. To be known when we met away from the laboratory was the extreme form of recognition I expected.

On the morning of March 29 I met him near the lake digging with one foot for tarantulas. He stopped work as I approached and came toward me with an expression which I interpreted as saying: "You haven't a banana about you, have you?" But before I could explain that I had not expected to meet him, etc., he smelled his own reply and returned to his digging.

Two days later, knowing I would pass this way, I placed a small banana in my sack on the chance of meeting José again. Sure enough, there he was hopping down the hill toward me, the injured foot held high. This time his expression read "What about that banana?" and I replied "Well, what about it, José?" He sat there on his haunches waiting for me to make the next move, but as I remained motionless, he came forward, went direct to the bag at my side, extracted the banana and ate it at my feet. He did not ask for another, for he knew as well as I that there were no more. Then he went into the forest but soon returned to hunt grasshoppers about me as though he sensed a safety zone in my vicinity.

His only friend—man

As the time for my departure at the end of April approached, José was returned to his friends at the kitchen door. New fur was sprouting from the bare patches on his body, but he could not hope for a new eye, and I doubt if ever again his foot will serve him as an effective weapon. With our bananas and his discretion he may survive until another mating season brings with it the desire for a mate and forces him to re-enter the lists. Then the loss of a foot, as well as an eye, will prove too great a handicap and José will meet the end of the male of his species. But he will have added to our knowledge of a coati's life. His sisters, in due time, doubtless had families of their own, but since reaching maturity José's only contacts with his kind have been to fight and to mate. Aside from these brief periodic exhibitions of animalism he is alone in his world. In sickness and in hunger he is dependent solely on himself. Other forms of life may serve him as food; with man alone can he hope to make friends.

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*Since the above was written I have discovered the following in *Science* for June 26, 1936:

"Licking their wounds, a practice universal among animals, has good bacteriological justification, is reported by Dr. Herman Dold, professor of hygiene at the University of Tübingen. Cultures of bacteria to which saliva was added failed to thrive, while untreated 'control' cultures grew flourishing colonies of the germs. It therefore appears likely that in addition to keeping dirt and hair out of their wounds by the constant licking, the afflicted animals are also applying an effective antiseptic."

José

(Above) A portrait of the coati whose intelligent actions have for two seasons entertained the Museum's expedition at Barro Colorado near Panama: a battle-scarred veteran of the mating season, with only one good eye, a defective upper lip and a split left ear

(Right) Breakfast at the author's knee: an expression of mutual confidence

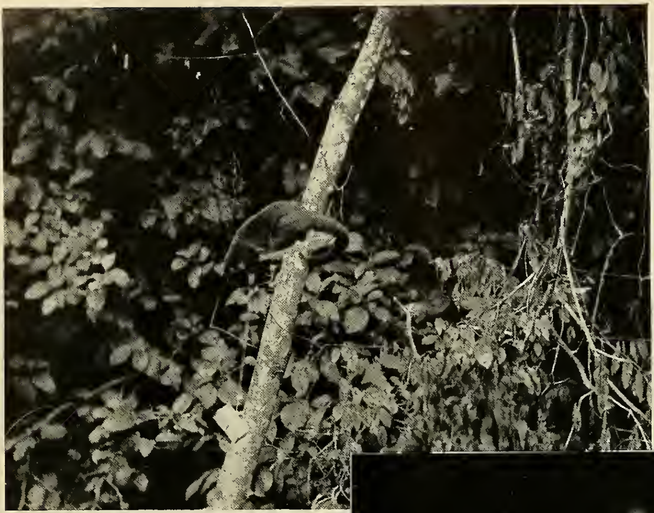
(Left) After seven months of easy living José was quick to resume his training in aerial acrobatics. Here he is shown 'tightrope' walking to the tray which contains his favorite food, bananas

1936

(Above) José is shown circumventing the tree guard which coatis could not pass. José avoided it by coming from above, and walked the single wire to the food tray, a distance of 15 feet

(Left) Pulling a banana down which is attached to a string thrown over a single wire

In the picture at the right the single wire to which the banana was tied did not reach the ground, so José climbed out and pulled it up as shown



José's intelligence was displayed largely through his keen sense of smell. If the suspended box shown above contained a banana he would pull it up, but if it held only a stone he made no attempt to obtain it

Complete confidence in man—his only friend: José eating a standing meal at the author's doorway. His left shoulder and forefoot show some of the wounds sustained on his second mating expedition which seriously threaten his chances in the struggle for survival

The Desert Fish of Death Valley

It seemed impossible that fish could exist in a spring in Death Valley, far from the nearest water, but there they were, survivors of the Ice Age

By William V. Ward

Could anyone believe that there are fish in California's Death Valley? Hardly; at least no one would entertain for a moment any such thought who had gone, as a tourist, through that sun-scorched furnace-heated region where streams are unknown and where the only pools are those of bitter waters.

Thus, when I read from a newspaper a colossal story of a certain spring in Death Valley wherein live and abound a thriving species of fish, I thought that perhaps the reporter had had a slight touch of the sun. However, the article was written in so reasonable and coherent a style that it gave a suggestion of truth and most certainly provoked curiosity. The newspaper story really was not unduly exaggerated; it merely gave the surprising information that at Saratoga Springs in the southernmost portion of Death Valley, about twenty miles from the lowest point on the North American continent*, there were to be found living in the salt water of that spring, a certain species of small fish. And that was the fact which interested me, and caused me to wonder.

To bring 'em back alive

Being somewhat of a scientific turn of mind, I decided to go at my earliest convenience to Death Valley to investigate these unusual fish and to try to photograph and collect specimens of them. Then, too, perhaps I had in mind exposing as a nature-fakir the writer of that newspaper yarn. So, when time permitted, the trip was undertaken. Food was prepared for a desert camping trip: water jars were filled, fish nets were made, thermos jugs were procured in which to place a few fish in an effort to bring back specimens alive, if any were found; cameras were loaded, and a small special aquarium was taken along in order to obtain photographs of the fish in the field in case it should be impossible to bring them out of the valley alive. Thus equipped, a fishing expedition to Death Valley was under way.

Into the desert

The springs described were found quite easily after a preliminary study of various maps and then, after arriving in Death Valley, by watching for the desert water-hole signposts which have been erected there by the United States Geological Survey. The roads leading to the springs where the fish were said to exist are clearly marked, for the springs are among the largest in the whole Mojave Desert, and they long have been noted as a camping place for desert travelers. Even the Indians had been there, as picture writings on the face of a rock wall a few hundred feet to the southeast testified.

Late in the afternoon, after a long, hot journey across the desert, the car came to a jolting stop beside a circle of reeds, surrounded by salt grass, which marked the location of a water-hole. Stiff-legged from driving, I climbed out, pressed my way through the reeds, and looked into the pool.

Wonder of wonders, if the newspaper story wasn't right! There were the fish! A thousand of them, playing and fighting in the depths of the pool. Slanting rays of light from the afternoon sun reflected themselves from the iridescent blue sides of the males as the fish darted in and out among the reeds and sunbeams.

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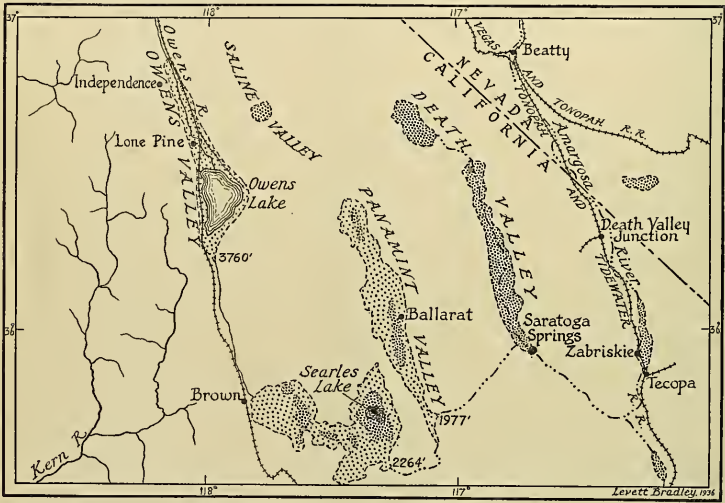
* 276 feet below sea level.

The pool was oval in shape, about twenty by thirty feet, and from two to five feet in depth. The bottom was covered with decayed vegetation except in several round, sandy spots ranging from one to three feet in diameter through which the water bubbled from its underground source. As each new jet of water came in, the sand would shift, rise up in a little whirling pillar and then fall away; and ever among these swirling pillars of sand the fish were darting in and out, evidently merely to enjoy the tickling sensation of the sand.

An investigating glance around the springs showed that the one I was standing near was the central pool from which the water flowed through several small ditches, heavily choked with vegetation, to two other pools each of which was an acre or so in extent. These larger pools were quite shallow and around their edges waded a few killdeer and a Wilson phalarope, while on the surface swam green-winged teal and western grebes. Red-winged blackbirds were at home in the reeds. The larger, shallow pools, together with the surrounding marshes and tangled ditches which connected the several pools, formed a breeding ground for the fish, the small ones of which could be seen swimming in schools close to the surface. Here in the shallow water and among the matted vegetation and algae, the young fish were able to hatch and to grow unmolested, until they were big enough to return to the central pool and cope with their vicious cannibalistic parents.

Looking up from the pools and marshes for a quick glance at the topography, one's eyes met the barren, rocky slopes of a spur of the Ibex Mountains, which border the eastern side


118°
117°
37°
36°
Owens R.
Independence
Lone Pine
Owens Valley
Saline Valley
Owens Lake
3760'
Panamint Valley
Ballarat
Searles Lake
Brown
Kern R.
1977'
2264'
Death Valley
Nevada
California
Beatty
Vegas and Tonopah
Tonopah R.R.
Amargosa River
Tidewater and Tonopah R.R.
Death Valley Junction
Saratoga Springs
Zabriskie
Tecopa
Levett Bradley. 1936

How the Fish Got into Death Valley

This map shows a vanished lake system which probably existed in Southeastern California in the glacial epoch. At that time Death Valley was presumably the overflow basin into which drained the waters from the surrounding glaciers and mountains. The fish are believed to have entered Death Valley by these waters and have survived there in the restricted salt waters of Saratoga Springs, completely cut off from all other waters of the world and only twenty miles from the lowest and hottest place in the United States

The shaded areas were occupied by lakes of the Pleistocene epoch; and the darker shaded areas represent playas, or plains intermittently covered with shallow water. Searles Lake is not a lake in the ordinary sense but occupies a salt-incrusted surface and varies in size

(After Hoyt S. Gale, Bulletin of the United States Geological Survey No. 580)

of the Valley; while to the northward, across the dry bed of the Amargosa, one saw through a haze the snow-capped crest of Telescope Peak as it rose eleven thousand feet above the heat waves which shimmered over Death Valley. Indeed, it was a strange and picturesque setting in which to find fish; so much so, in fact, that it caused me to cease exploration for the moment to determine why the fish were there.

It was clear that they could not have come to these springs from any other pools in the region. The nearest other water was miles away; and an examination of the U. S. Geological Survey water-supply maps for the Mojave Desert showed that it would be an impossibility for the fish to travel between pools even in times of heavy rains and floods. Therefore, it seemed most reasonable to presume, as do Stanford University icthyologists who are studying the desert fish, that the little minnows are descendants of those which once inhabited the area at a much earlier geological period when the desert had a moist and humid climate, and when the present arid basins were lakes and the dry water courses full flowing rivers. Such a time was probably in the Pleistocene when Lake Bonneville and Lake Lahontan covered with fresh water much of the territory in the southwestern United States; and when the Mojave, Amargosa and Owens Rivers connected the present springs, dry lakes and washes in an integrated river system which drained the melting glaciers then on the neraby mountain ranges.* This drainage system is depicted in the accompanying map and diagram.

These fishes of Saratoga Springs belong to the hardy family of *Poecillidae* (killifishes or Cyprinodonts) and are known to science as *Cyprinodon macularius.* They are known commonly as "Death Valley Fish," "Desert Minnow," and "Spotted Pursy Minnow"; and variations of the type specimen are found

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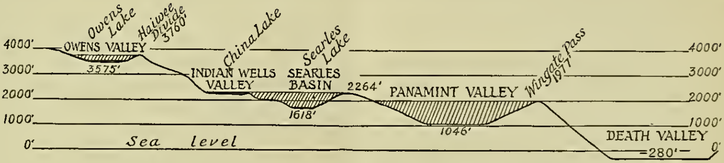
* "Waters that formerly filled Owens Valley until they overflowed, flooding successively lower and lower basins, formed for a time a chain of large lakes in what is now the desert region of southeastern California. These flood waters passed from Owens Valley, the principal source of the water supply, through Indian Wells, Searles, and Panamint valleys, in each of which there was an extensive lake. Finally the waters are believed to have overflowed also into Death Valley, and there the physiographic record has not yet been completely deciphered. . . .

"Panamint Lake narrowed to a point at its south end, and this was not only the point of inlet for the overflow from the Searles Basin but it appears that the inlet was also near the position of its probable outlet or overflow during the period of its maximum flooding. The greatest depth of Panamint Lake was probably determined by Wingate Pass, through which an overflow is believed to have passed for some time into Death Valley. . . .

"The final bit of evidence concerning the maximum water level of the Panamint Lake was found in the contouring and elevations in Wingate Pass, which leads from the Panamint Valley into Death Valley. These data were obtained in recent surveys for maps now in preparation. . . .

"The correlation of the Quaternary lakes of Owens Valley and similar areas in the Great Basin with the stages of ice extension in the glacial epoch rests upon general considerations, although it is accepted by most geologists. . . .

"It is stated that the greatest expansion of the waters of the Mono Basin occurred subsequent to the last extension of the Sierra Nevada glaciers. It is reasonable to assume that the other lakes of the Great Basin attained their maxima at the same time." (Hoyt S. Gale, in *United States Geological Survey, Bulletin 580,* "Salines in Southeast California," pp. 251-323.)



Death Valley at Foot of Former Lake System

The isolated fish which live in Saratoga Springs in Death Valley are believed to have come at a time when a more humid climate connected the basins shown here in profile into one system

(After Hoyt S. Gale, Bulletin of the United States Geological Survey No. 580)

in desert water-holes throughout the Southwest. "Death Valley Fish" seems to be quite appropriate for the specimens at Saratoga, for no other fish are found in Death Valley. They attain a maximum length of from two to two and one-quarter inches. The males have slightly barred sides which become a brilliant iridescent blue when the light strikes them at the correct angle; but at other times they appear to be plain gray, with sometimes a reddish-brown tinge when one is looking down at them in the pool. The females lack most of the iridescent blue and are a little paler than their mates, while they have vertical bars on their sides which are much more prominent than those of the males. The fish are omnivorous, eating both vegetable and animal foods. This is apparent to the observer who watches a group of them carefully eating the algae off some plants at the bottom of the pool, and then sees them make a lightning dash to the top of the pool to make short work of an unfortunate moth which chances to be blown into the water.

How to catch them

It was necessary to catch several fish for photographic purposes as well as to obtain a few to attempt to bring home for aquarium specimens. The rapidity of movement of the fishes in the water made it almost an impossibility to even try to scoop them up in the nets brought for the purpose. However, the easiest way to catch them soon was discovered. An insect would be placed on the surface of the water, and its struggles quickly would attract a number of fishes. While they were busy attacking the insect, the net would be slipped quietly beneath them and they would be captured. Then they were transferred to a waiting thermos jug to be carried home, or else placed in a small aquarium, the front and back walls of which were close together so that they would be confined in a narrow plane while their photographs were made. It was but a matter of a few more minutes to catch from eighteen to twenty fish of both sexes and of various sizes and to place them in thermos jugs for the trip home. Five or six more were caught for the purpose of making their pictures. The small glass aquarium was made ready and the fish placed in. Afraid at first, they made fairly good camera subjects as soon as they had thoroughly investigated their new surroundings and had settled down a bit.

In sweeping the nets about the pool, it was found that fish were not its only denizens. A brown leech, of about four inches in length, was rather common, as was the yellow-bordered water beetle, *Dytiscus*. The water beetle, apparently, was the only enemy of the fish aside from the frogs. It was seen swimming constantly along the edges of the pool searching for young fish which it kills by clasping them with its strong fore-arms, while its proboscis pierces the fish's back to suck its blood.

Temperature of the water at Saratoga Springs was found to be quite high, ranging rather closely between 82 and 83 Fahrenheit, and to maintain that temperature consistently, as it is a warm spring. No doubt the temperature of the surrounding shallow pools, which are away from the source of warm water, fluctuates quite widely as does the air temperature from night to day and summer to winter. Death Valley is one of the hottest regions in the world. The minimum daily temperature in summer is rarely below 70° F. (in the shade); and the maximum may, for days in succession be as high as 120°, and the U. S. Weather Bureau has recorded an extreme of 134°. But even though the fish might be used to wide temperature changes it was deemed most advisable to transport them the three hundred miles out of the desert in thermos jugs in order to maintain a constant temperature; and in that manner all of the specimens arrived home safely.

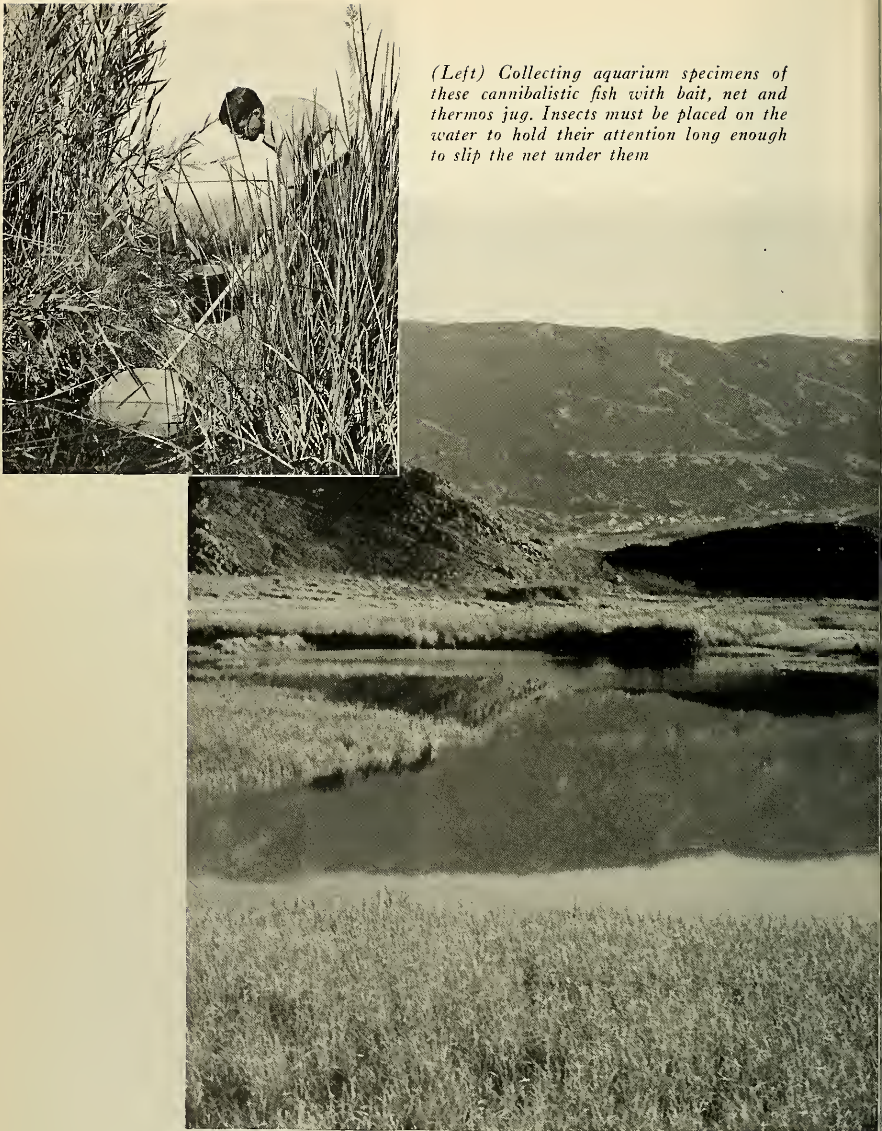
As aquarium pets

The fish have made most interesting aquarium specimens for well over a year. Some have lost their lives through their very ardent pugilistic activities; but much of this is avoided by keeping the aquarium thickly planted. Temperature variations seem to cause no great harm other than a loss of color and vivacity. They still live in water brought from Saratoga Springs, but this has been diluted with an equal volume of tap water, thus considerably reducing the alkalinity and salinity. One looks at these little minnows pushing their way determinedly about the aquarium and knows that they are "tough" fish, as well they must be, to have survived since the ice age in a little pool in Death Valley only twenty miles from Bad Water, the lowest and hottest place in the United States.

The Desert Fish of Death Valley

Death Valley, the lowest, hottest region of the United States, might not seem a likely place to find fish. Yet the salt pool shown below is the breeding place of myriad finny survivors of the Ice Age

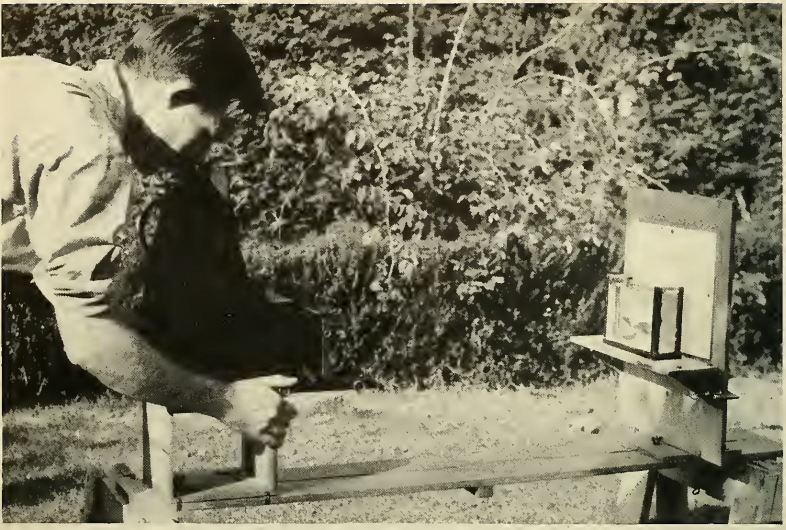
(All Photos by William V. Ward)



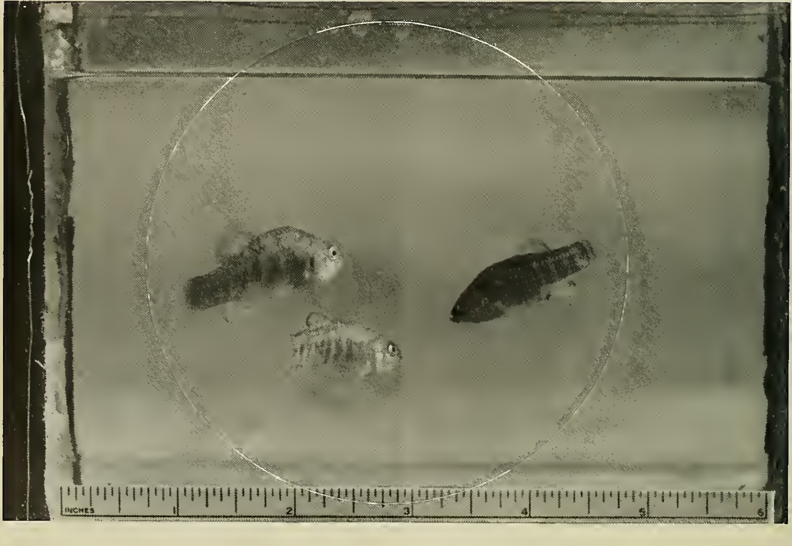
(Left) Collecting aquarium specimens of these cannibalistic fish with bait, net and thermos jug. Insects must be placed on the water to hold their attention long enough to slip the net under them

From the shallow, marshy pools where the fish hatch they swim into the central pool shown below to wage their struggle for existence with their cannibalistic parents. It is believed that they are survivors from the Glacial Age, when the desert had a moist climate and fresh water covered much of the territory in the southwestern United States

The captured specimens were put in a thermos jug, which was later found unnecessary, as the fish are so hardy as to need no temperature protection



Photographing specimens of the Death Valley fish. A special aquarium was used in order to keep the fish in focus and to obtain true-size pictures



The Death Valley fish (Cyprinodon macularium), *about three-quarters life-size. The females (left) have prominent vertical bars on their gray sides, while the male (right) is a brilliant iridescent blue with faint vertical bars*

The Tragedy of the Culbin Sands

An amazing catastrophe which changed a section of the fair Scottish countryside into a miniature Sahara and made time stand still for more than two centuries

By H. Mortimer Batten

In the autumn of 1694 there occurred at Culbin, on the Moray Firth, midway between Nairn and Forres and just where the wonderful and varied River Findhorn joins the sea, one of the most curious calamities which has ever occurred in Scotland. Curious yet tragic, for in Great Britain one hardly expects the overwhelming forces of Nature to make themselves felt.

One autumn afternoon a wind sprang up from the sea bearing with it the sting of flying sand. Little was thought of it, for in spite of the wonderfully mild climate of that area of Scotland, which lies open to the sun yet is sheltered from the cold winds by the Grampian Mountains, autumn storms which piled up sandhills and caused the sea to make great inroads into the coast, were not unusual. As the wind strengthened, however, the sand thickened, and its onslaught became so fierce that laborers in the fields were compelled to leave their ploughs in the half-cut furrows, where many of them remain to this day.

The storm rises

As night came on, the fury of the storm passed all records. It was then that some of the villagers recollected that some days previously an old woman, supposed to possess the powers of witchcraft, had visited the village in search of charity which had been refused from door to door. On finally leaving the village she breathed a curse upon its inhabitants. The fear of a witch's curse was strong in Scotland in those days; in fact, less than a century ago, such powers went unquestioned, and even today there are many who shrink in terror from the curse of an old woman, just as there are many who would go far to obtain for their children the blessing of very old people.

That night the fear of being buried alive descended upon the inhabitants. The sand clouds were beating in waves upon the village, so that fishermen's cottages, the laborers' dwellings, and the improved grounds surrounding the fair barony of Culbin were rapidly becoming drifted over. At midnight the villagers fled. The young Laird with his wife and baby made their way out of the storm-stricken area with the rest, and one can picture the procession, for in those days there was no way of spreading information as to the kind of calamity which had befallen them.

The Laird and his wife found refuge at Earnhill, but next morning the storm had abated and the villagers returned.

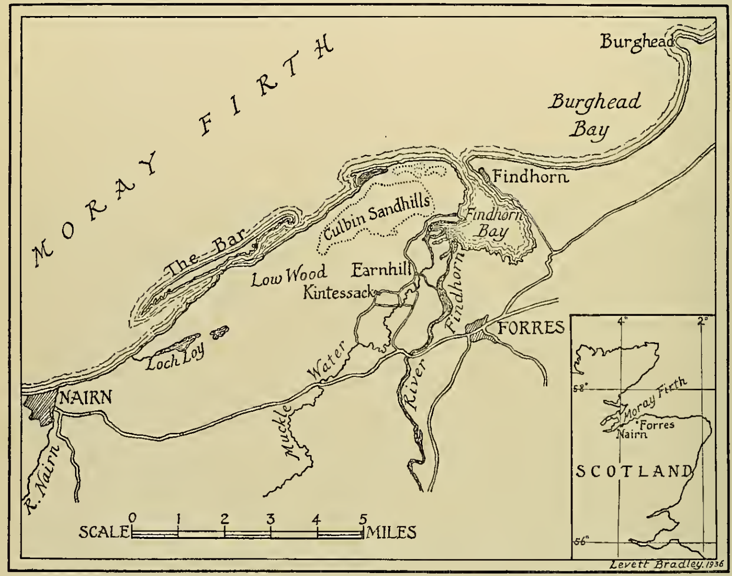
The village buried

They found their cottages covered, only the roofs and chimney pots showing, but by digging down they managed to release their horses and cattle, which were then driven inland. That night the storm recommenced with double fury, and next morning not a vestige of the village was to be seen. Millions of tons of sand buried the houses, and sweeping far inland was a vast and tumultuous desert of sand. To the people of Culbin it was incredible that this vast accumulation, built up in a few hours, could have come by the ordinary course of things. It was said by many that the depths of the sea actually disgorged the sands, and naturally all kinds of rumors and superstitions were current for many years.

The Mansion House of Culbin was, it seems, a square building standing on level ground, surrounded by its garden and grounds. The immediate lands were rich and profitable, for the area was known as the granary of Moray. Adjoining the house was a stone-built dovecote, the privilege of the Barony, but now all was irrevocably buried and lost to man's tenancy. The Kinnairds were practically ruined.

The following year the young Laird applied to the Scots Parliament for a release of land tax on the grounds that by an act of God two-thirds of his estate had been destroyed. Parliament granted the relief sought, and at the same time passed an act prohibiting the pulling of bent, juniper, and broom, the binding roots of which help to make the sandhills permanent. The act is still in force. And one of the most interesting planting schemes is at present in progress in order to fix the dunes to prevent the sands working further inland. Marram grass is planted at short intervals, and other plants, such as *Carex arenaria,* which have strong, running roots, have at last obtained a hold on some of the more dangerous slopes. Corsican pine, Sea Buckthorn and grey alder are systematically set by the foresters, who are ever watchful for dangerous "blow outs" which might result in wholesale movement. In stormy weather it is unsafe to penetrate the area. Many lives have been lost there, and in very few instances is the body recovered.

The remainder of the story of the Kinnairds, succeeding their midnight flight from Culbin, is a sad one. Apparently the Laird and his wife lived in poverty, and both died a few years later. The little boy was taken charge of by a faithful old servant, who journeyed with


MORAY FIRTH
Burghead
Burghead Bay
Findhorn
Culbin Sandhills
Findhorn Bay
The Bar
Low Wood
Earnhill
Kintessack
Loch Loy
FORRES
Findhorn
Muckle Water
River
NAIRN
R. Nairn
SCALE 0 1 2 3 4 5 MILES
4°
2°
58°
Moray Firth
Forres
Nairn
SCOTLAND
56°
Levett Bradley 1936

A SMALL SAHARA IN SCOTLAND

The dotted lines in the above map mark the once fertile section of Scotland which a two-day storm in 1694 buried beneath millions of tons of sand. The area has ever since remained a barren waste of shifting dunes. In stormy weather it is unsafe to venture into it. Many lives have been lost there, and rarely is the body recovered.

him to Edinburgh, where she earned money for him and herself by her sewing. The boy passed into the regular Army, and it is strange that it should have been left to Ireland to recognize him. He obtained a captaincy, but died young and unmarried.

For a hundred years there was no record from the desert area. The sands sighed and the wind moaned, a region forsaken by man and utterly worthless. Then one day the roof of the old Mansion House appeared like a ghost from the shifting, drifting area. There can be no doubt about this, for workmen were at once sent to carry away the most valuable stone work, but its reincarnation was short, for in a few days it was again swallowed up in the ever-moving desert.

A living tree

Until recently there lived an old man who told how one day an apple tree was revealed from a corner of the Culbin House orchard. In response to the daylight it promptly burst into blossom which quickly matured, as though the tree were giving forth its best to propagate its kind, but the sands closed again, and it was lost.

The Culbin sands are forever shifting. The faintest eddy of wind sends sand-storms scudding across the white glitter, and a real wind entirely alters the lay of the country in a single night. Even on a still day the sands are continuously creeping; but the silence is absolute. There is no droning of insects, no song of birds, or rustle of leaves. Such timber as exists is stark and leafless. Overhead the sky is of the clearest and most intense blue, and if from the crest of the sandhills one overlooks the surrounding wold country, the fields and woodlands are endowed with a richness of coloring unrivaled elsewhere. Only on the dullest days does the sky darken overhead, and while the sands are yellow after rain, they are normally of pearly whiteness. In some lights the desert is overhung with a golden glow which seems to emanate from the sand, and I am told that when darkness gathers, the surroundings are apt to assume an unearthly purple stain, such as is sometimes seen over the Arctic snows. One of the most curious features of this land is that distance cannot be measured by eye. A companion fifty yards away may appear as a far distant figure; a slope rising almost from one's feet may appear on the remote skyline.

For centuries the port of Findhorn carried on an active export with England and the countries of continental Europe, and the interest of this extraordinary region is enhanced by its historic relics. Industries which required a high degree of skill were carried on over the area now obliterated, and when the winds lay bare the naked soil, the hoof marks of cattle and even the imprints of man himself are found as clearly impressed as on the day they were made. In the Edinburgh Museum there is an immense collection of flint arrow-heads, saws, scrapers, and knives, taken from the Culbin area. These have been picked up by casual collectors during the past fifty years, but by no means are there signs of the supply becoming exhausted. Anyone visiting the place is sure to find such relics. Numbers of articles of bronze manufacture have also been found, rings, rivets, studs, and pins, also crucibles and molds of stone. A beautiful bronze armlet of ancient Celtic pattern was recently discovered, also a small penannular brooch, one of several, was picked up by a lady, while another lady found a massive bronze finger-ring and a bronze spear-head.

Historical relics uncovered

I saw a collection of coins made by one who had visited the region for that purpose. They were extraordinarily varied, being of Roman, French, English, Scottish, and Flemish mintage. The coins range from 21 B.C. to the time of Charles II. With one exception there have been no known discoveries of treasure. At one time, a laborer working near to the area of the sands, found a bag of silver coins. They proved to be pure silver of the highest grade, and the man at once hid his find from his fellow workmen. That night he and his wife returned for the money, and from a laborer he became a farmer of some standing. His story, of course, leaked out, and some of the coins were traced and duly identified.

For all the lifelessness of the Culbin sands, the surrounding country is rich in bird and plant life. Sea birds of many kinds haunt and breed in the wild region where Findhorn joins the sea. Water plants of many varieties abound, and the Findhorn valley, so dearly loved by Charles St. John, is, from the mountains to the sea, one of the most varied and remarkably beautiful in the British Isles.

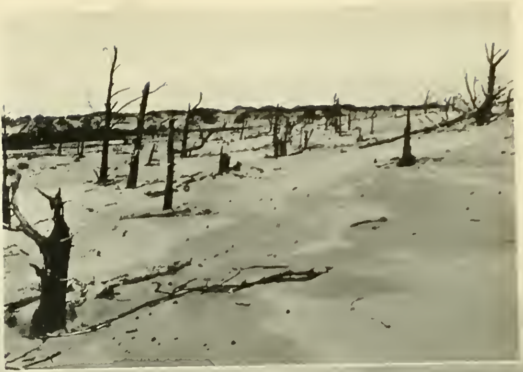
The Tragedy of the Culbin Sands

A HISTORIC CATASTROPHE IN PICTURES BY H. MORTIMER BATTEN

In 1694 a witch's curse was followed by a two-day sandstorm which completely buried the fertile Scottish barony of Culbin. The accompanying photographs show the scene of this astounding calamity as it appears today

After fleeing by night to avoid being buried alive, the villagers the next day found only the roofs of their cottages showing, and had to dig to release their imprisoned cattle. A day later not a vestige of the village remained in sight

Stark, leafless timber: once an apple-tree thrust out and blossomed in the sun; then the ever shifting sands closed over it, reclaiming their own



A sudden wind will entirely alter the landscape overnight

To be caught in a storm in this small Sahara is extremely dangerous

On a still day the silence is absolute. There is no droning of insects, no song of birds, or rustle of leaves; and distances are strangely deceptive

Beneath the millions of tons of sand lie plowshares abandoned in their furrows and innumerable historic relics, many of which have been found by collectors

Your Treasure-House of Jewels

A review of "The Story of the Gems" by Herbert P. Whitlock, a handbook to the position of precious stones in Nature and in human life and philosophy

By GEORGE C. VAILLANT
Associate Curator of Mexican Archaeology, American Museum

MR. WHITLOCK, Curator of Minerals and Gems of the American Museum of Natural History, has had to combine in his professional work, the bleak research of a pure scientist, the joyful acquisitiveness of a collector, a professional appraiser's canny skill in evaluation, and the aesthetic sensitiveness of a connoisseur of lovely things. The joining of these varied points of view goes to make *The Story of the Gems** far more than "A Popular Handbook" as his subtitle modestly states, but rather a delightful description of the meaning of the author's Hall in the Museum, revealing as many planes of interest as the more intricately cut of his treasures possess facets.

Written for the layman

The plan of the book is broadly and logically conceived. An introduction defines gems and explains the reasons for their value. Then follows a chapter on the history and development of jewelry with emphasis on precious stones. Since the appreciation and esteem for such objects on the part of Man have caused him to direct much inventiveness and technical skill to their preparation as ornaments, Mr. Whitlock gives two fascinating chapters on the art of the lapidary and the methods of cutting precious stones.

Having laid down a basis for the appreciation of gems, the author describes the chief groups of precious stones. The diamond well merits its two chapters, the second of which describes the most famous stones of this class. Another section covers rubies, sapphires, and emeralds. Two chapters describe semi-precious stones like topaz, tourmaline, spinel, and zircon; and chrysoberyl and opal are considered apart, as semi-precious stones that have advanced into the precious grade through intrinsic beauty and popular demand.

The quartz gems, rock crystal, amethyst, onyx, and the like, are placed in a special category since not only are these substances used as jewels but also in small objects involving artistic as well as technical skill in manufacture. Opaque gems like turquoise and lapis lazuli and a number of less known varieties have a chapter, as does deservedly jade. A chapter on unusual gem stones opens delightful possibilities for ornament, and the final chapter is devoted to such organic products as pearls, amber, coral and shell, all of which have been used as jewelry. A bibliography, a descriptive table of gems and an index complete the volume.

Handsomely illustrated

The illustrations are excellent. First and foremost is the frontispiece, a double page in colors, presenting twenty-four jewels. The play of light in these superb specimens is so faithfully reproduced by the artist that one almost seems to behold the actual gems. Judicious use is made of photographs, illustrating not only the chief treasures of the Morgan Hall but also the technique of preparing them. A lucid series of diagrams aids vastly in the understanding of the types of gem cutting.

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* *The Story of the Gems,* Herbert P. Whitlock, pp. ix, 206, illustrated. Lee Furman, Inc., New York, 1936. $3.50.

This outline gives the summary of a competently prepared handbook, but the *Story of the Gems* contains much more than the description, analysis, and appraisal implied by such a volume. Mr. Whitlock, by the use of anecdote and observation, by the heading of his chapters with astutely selected quotations, brings out constantly in his pages the relation of man to the stones he considers precious. He places as much stress on the aesthetic values of his subject as he does on the scientific, nor does he fail to lay due emphasis on the technical considerations of craftsmanship.

This approach brings out very strongly that there is far more to the appreciation of precious stones than a knowledge of their mineralogical rarity or their market value. In fact, to some of us the cost factor has become so overwhelmingly important that the intrinsic value of gems has been obscured by the ignoble one of extrinsic or commercial worth. In the Fine Arts, heavy as is the shadow cast by the astronomic prices of masterpieces, it is not yet able to dim their genuine intrinsic value to a public educated by school and museum to the appreciation of craftsmanship and aesthetics.

Yet it is rare to find an individual so absorbed in the subtle refractions achieved by the inherent beauty of his stone enhanced by the skill of the lapidary, as that same individual would be in a painting or a sonata. One might almost draw the grotesque analogy that if the public attitude to the fine arts were like its appreciation of beautiful gems, we would find on great occasions like the opening of the opera season people parading like sandwich-men placarded front and rear with masterpieces of Italian and French art, or else laboring their heaving way beneath an ancient Greek statue, vying as to whose was the heavier or more complete.

What makes gems valuable

Mr. Whitlock, however, shows very clearly why the major gem stones occupy their supreme position among jewels. Their supremacy is due to their qualities of color, hardness, transparency, and refraction of light, and not to the machinations of middle-men and super-salesmen. Fashion, of course, as in every other aspect of human life, plays its part, and to some the delicate carving of the emerald from Delhi might seem a sacrilege, since brilliance was sacrificed to graphic design. Certainly few stones can compare with the "Star of India," the sapphire that is queen of the Morgan Hall.

Such treasures are for the few. None the less there are marvelous effects to be attained and pleasures to be derived from the use of lesser stones, which because of fragility or lack of high refraction cannot take their place with the major examples of the diamonds, sapphires, and rubies. It seems such a waste to see worn in every American community those sad little diamonds, symbolizing all our social striving, when for the same cost a rich and satisfying gem like a topaz or an opal could be obtained.

Beauty not always costly

A visit to the Morgan Gem Hall, one might almost say to Mr. Whitlock's treasure house, offers infinite possibilities for the gratification of one's most lusty craving for personal adornment. The wide variety of minerals—precious, semi-precious, and common—present possibilities for jewels which, unlike diamonds and rubies, are not, in the strictest sense of the phrase, kings' ransoms.

The late Dr. George F. Kunz called attention to the possibilities in this direction but without success in diverting public taste to a more abundant source of supply. To be sure there was some innovation in utilizing as gems stones whose value was enhanced because of their scarcity. The wearing of inexpensive but handsome stones has a further application in these days of brigandage, no less severe if more furtive than in days gone-by. It seems highly unenterprising to wear imitations of known gems when it is possible to explore fresh fields of beauty, or even to return to more primitive days when lesser gems set in relation to their settings made adequate ornament without stressing the absolute value of the stone.

Mr. Whitlock, however, gives an additional reason, Romance, why the major stones will always keep their allure. Gems are indestructible, and by changes in cut and in setting a famous stone may pass through a varied, at times bloody, history. There is a peculiar fascination in speculating as to what extremes of human cupidity governed the successive ownership of the diamond in one's ring.

A handbook is not expected to appeal to all types of interest, but the *Story of the Gems* almost reaches that goal. The problem of presentation in a handbook is very much the same as that in preparing a Museum exhibition. The book and the hall ideally should interest as well as instruct, and both must therefore be capable of touching at some point the most extreme reaches of human social experience.

Mr. Whitlock's use of quotations to introduce each phase of his theme, is a delightful means for bringing his subject within the range of the layman. Thus before describing the famous diamonds of the world he quotes from Pliny:

"The greatest value among the objects of human property, not merely among precious stones, is due to the adamas [diamond] for a long time known only to kings and even to very few of these."

Jade through the ages

This description tallies very well with the impersonal quality of the precious stones. The chapter on jades, however, is prefaced by an observation of Confucius', "In ancient times men found the likeness of all excellent qualities in jade." The all too brief chapter on this singularly subtle carving of a stone that ranks as precious in the East and in pre-Columbian Central America, but in the Western World does not attain jewel quality, becomes invested with the pervasive charm of the East.

In the case of jade, one enters the field of what might be called subjective jewelry, since the chief pieces of carving are meant to be contemplated by the owner. In contrast to jade, diamonds and the like have an objective quality, for they are worn as much to impress others as to give the wearer direct satisfaction in their mere possession. Whereas technical consideration of workmanship enhances the brilliance of a jewel, it takes a consummate artist to create a lovely jade.

The intricate patterns used to ornament Chinese bowls, boxes, or vases, retain in outline a gracious purity of line. Goddesses, gracefully poised, show the various qualities of character possessed by the divinity. Jade is as beautiful to touch as to see, and indeed the Chinese had special pieces to finger, so greatly did they appreciate the cool contours of this precious stone. The ancient Mexicans, too, esteemed the jade above all other minerals and it is tempting to think that it is an old folk-memory of their Oriental origin.

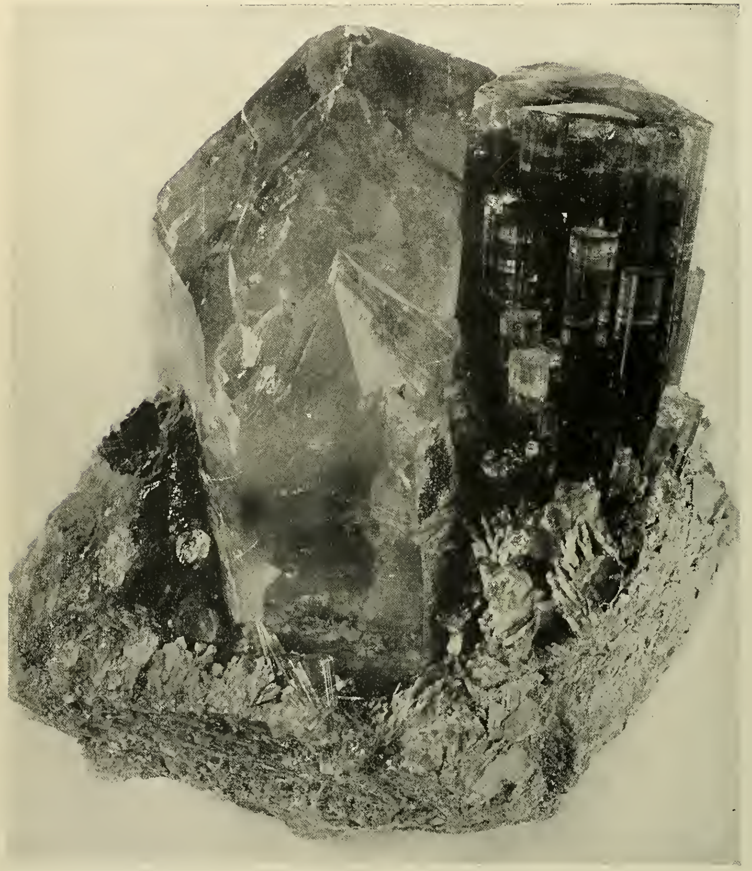
Between the gems and the jades there is apparent a conflict in standards of value. A flawless diamond is a work of nature dramatized by man's technical skill in revealing the innate properties of the stone. A master jade from China is precious not only because of its color but also because of the work of the sculptor who, in transforming the stone to a work of art, creates its highest value. In other words, in jade, art transcends the natural product. The early craftsmen of past civilizations were too concerned with finding means of subduing Nature and constraining it to their benefit, to be overly interested in preserving natural substances for their beauty. True they recognized some stones as more beautiful than others, but they used them as graded elements of a necklace, or in a setting, or as a substance to be carved. Natural products at first had to be subjected to human use, before they could be considered in terms of their own position in Nature. To the art historian, this primitive jewelry is more attractive than stones cut and set simply to enhance their natural properties. Yet these technically advanced methods of modern man reflect, perhaps, his lofty conception of the universe, which recognizes the limitations of man in the face of Nature.

A book for every one

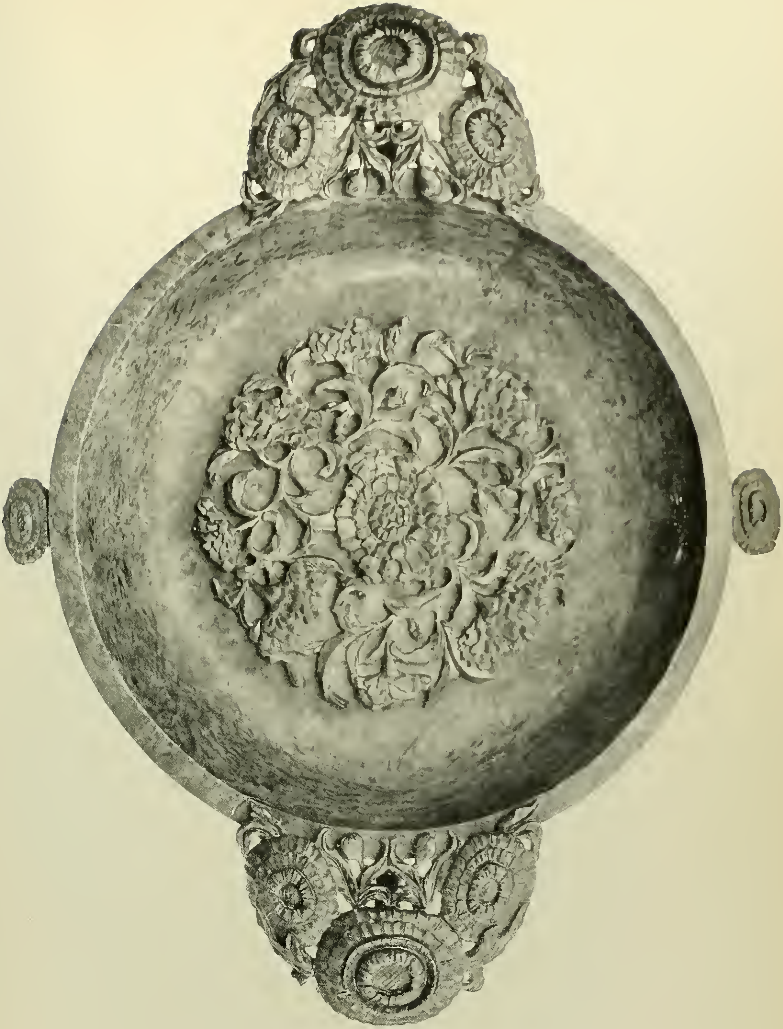
However, whether one be an aesthete, a craftsman, a mineralogist, a Marxian political economist, or better, someone with an open interest in the world around him, he will find that Mr. Whitlock has indeed told "The Story of the Gems," and has preserved a fine balance in the actual subject-matter as well as in the various aspects under which precious stones may be considered. Mr. Whitlock has, in simple language, made a complex subject intelligible, and he has set a standard worthy of emulation in all departments of the Museum, for the explanation of his Hall. It is easy to list and to explain specifically, but Mr. Whitlock has made it possible to see not only why it is of interest and advantage to have a mineral hall, but also why it is so essential to have collections displayed illustrating the physical basis of every subject. Mr. Whitlock has done us all, Museum visitor and Museum employee, a great service in his charming exposition of so fascinating a field of knowledge. He should receive our heartiest congratulations.

Your Treasure-House of Jewels

A SELECTION OF PHOTOGRAPHS FROM THE NEW BOOK, "THE STORY OF THE GEMS," BY HERBERT P. WHITLOCK

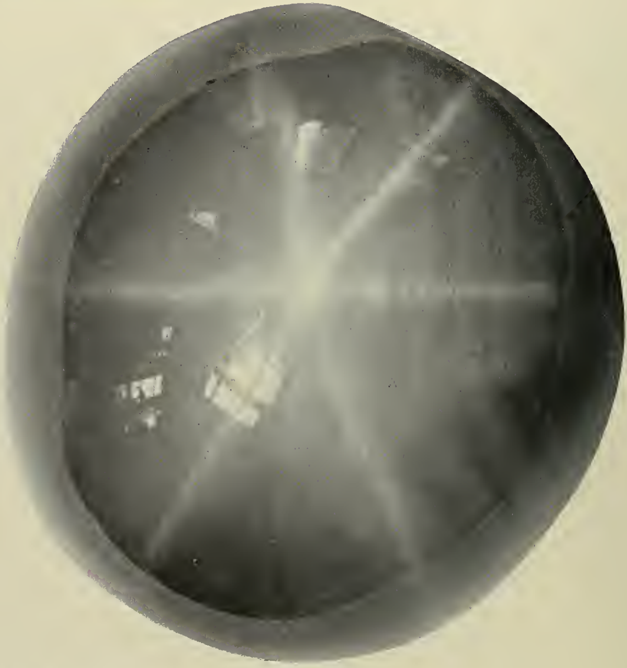


A group of gem crystals of tourmaline (rubellite) with quartz from Pala, San Diego County, California. These magnificent crystals are typical of the triangular tourmaline prism

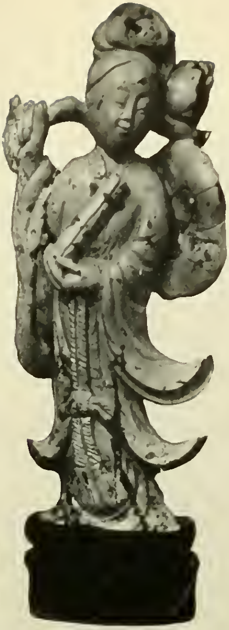


A large bowl carved with a design of chrysanthemums from spinach green nephrite. This fine carving represents the work of the Chinese jade carvers of the last century

With its 444 perfectly proportioned facets the blue topaz shown in the photograph at the left is a marvelous expression of the art of the lapidary

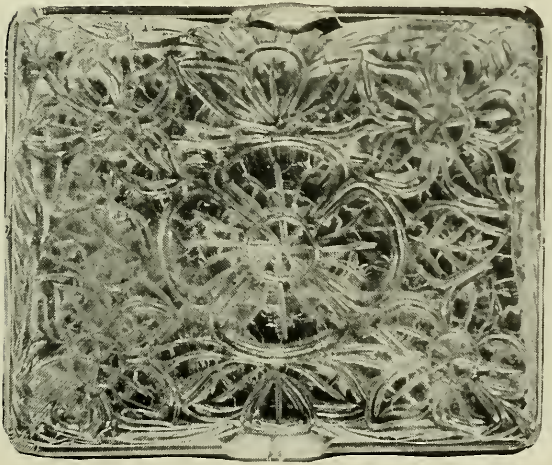


The "Star of India," the largest star sapphire gem known to exist, weighing 363 1/3 carats (Enlarged 3 times)



A figurine representing the "Goddess of Mercy" carved from Tibetan turquoise by a Chinese lapidary

The Schlettler Emerald: an 87¾-carat example of 16th century Delhi engraving. This stone, as well as the "Star of India" on the preceding page, is reproduced in color in "The Story of the Gems" *(Here enlarged 3 times)*



Mystery Animal

When no reasonable explanation could account for the killing of sheep and deer throughout New York State, a devotee of NATURAL HISTORY took up the trail to identify this mysterious predator

By FRED STREEVER

WOLVES, native to the Adirondacks, vanished from New York State during the last century. In my own County of Saratoga the last one of public record appears to have been killed in 1817 and a bounty of $10.00 collected therefor, though some scattered individuals persisted in the North Woods for many years more.

Rumors of a recurrence began to float about in hunting circles about 1930 and were followed by more or less circumstantial newspaper accounts of sheep, pigs and calves being killed all over the state, and in 1933 our County Board of Supervisors replaced the antique bounty of $10.00, at the same time declaring a night quarantine on dogs, which were suspected.

Dogs or wolves?

In the opinion of most hunters and trappers familiar through forty years of winter hunting on snow, where every trail is scrutinized and its maker identified, the stories of wolves were unbelievable. And when various pelts were turned in for the bounty we were not surprised to find one after another of them were pelts of "police dogs," some of whom showed signs of having been but lately divested of their collars.

All this talk of wolves seemed merely nonsense to me and comparable to the occasional panther stories still recounted beside the deer hunters' bivouac fires. "Where would the wolves come from?" said I, "with none south of the St. Lawrence River for over fifty years past?"

But one afternoon in mid-December, 1935, one of my friends called from the Court House where the Supervisors of Saratoga County were then in session and said they'd like me to say what I thought of an animal that had just been brought in for wolf-bounty. On the way I decided to avoid calling some good citizen a misguided nut who had killed another dog by saying that no identification short of dissection at the American Museum could be considered as positive.

Wolf!

The animal had been killed within a few hours and was not quite cold. He lay on the floor in the hall. There was quite a crowd around him as I came up the stairs, and somebody was saying, "He's a wolf all right." That riled me a little, and I had just got my mouth open when I noticed the short tail. Of course, that typical wolf brush was only a coincidence, I told myself; but the darn thing *was* higher at the withers and lower in the quarters than any dog I ever saw. I took a look at his feet (fur between the pads), and at his coat (dense fur underneath and mixed gray in color). Then they uncovered his mask: a slant eyed, sharp muzzled, curved tusked mug. And overboard went my caution.

"You can send him to Cornell or New York," said I, "for I think they'll want to see him; but for me, I'll go on record right now. It's a wolf!"

The pinch was, where *did* he come from? And if this was a wolf, there almost certainly must be others.

For me the wolf mystery thereafter remained in *status quo* until one snowy day in

January when our red fox chase with the hounds ended prematurely in the Grafton Mountains (across the Hudson River from our home). We were motoring back through the north end of the Luther Tree Plantation, an almost impenetrable thicket some 12,000 acres in extent of evergreen trees ten to twenty-five years old. In 1918 this had been the scene of many successful red fox chases both summer and winter, but the planted trees' growth had been increasing and the red foxes had about disappeared, so we had done no hunting there of late years. A new fallen snow presented its clear record of the ramblings of the night before, a maze of bunny tracks, a few grouse trails, a woods gray fox.

Strange tracks

And then we found what we were looking for but hadn't really expected to see. Strange tracks! As large as a dog's but with a more elongated footprint. Most interesting of all was the course of the trails, which as any woodsman will know determines his findings as much as does the footprint itself. A dog or even a fox would have sought the woods path for less obstructed travel but these tracks threaded the densest thickets.

During the remainder of January and early February, 1936, I tried at various times to get my older foxhounds to take the cold trails of the mysterious beasts on the Luther Plantation. Conditions were not of the best. Snow lay very deep and the hounds could do little but wallow through the thickets. Old Rambo, in his fourteenth year, seemed willing, but being a tremendously heavy hound he sunk so deep that little more than his head was above the snow, and progress was negligible. Some days we could not find a trail, nor was the weather often suitable. Late one cold February afternoon old Min, nine years old, trailed and found something or other that caused considerable and noisy excitement on her part, but before our snowshoes could get us over the three-foot snows to the scene, Min had changed her mind about it and thereafter refused the trails. We saw none of the beasts.

But we had come to the conclusion that there were five different individuals and that the range of the animals differed from day to day. They were in a different place every day but always in about the densest cover to be found. There appeared to be two females and three males, one of which was much larger than the rest.

Finally we decided to try some of the younger and perhaps less choosey Walker hounds from my Rafinesque Kennels, near Troy. So we drove down and brought back Keene, Penny, Shotgun Joe and Red Tugwell and waited for better weather.

The Museum is consulted

Meanwhile feeling that our evidence pointed definitely towards wolves in our local hunting grounds we wrote to the American Museum of Natural History and received the following prompt reply from Dr. H. E. Anthony, Curator of Mammalogy:

> AMERICAN MUSEUM OF NATURAL HISTORY,
> New York,
> February 28, 1936.
>
> Dear Mr. Streever:
>
> Your interesting letter of Feb. 27th arrives at a very opportune time. I have just today written a long letter to Mr. W. Winters, Acting District Game Protector, Saranac Lake Division, regarding the presence of canines in the Adirondacks.
>
> For several years now the Museum has been in touch with several of the Game Protectors in that region and with certain interested individuals in the attempt to secure a series of specimens to work out the ancestry of the packs of dog-like animals which are running at large, killing game, and behaving as wolves.
>
> There have been no wolves in the Adirondacks since the close of the last century. When these marauding canines were first reported they were said to be wolves, but when specimens were received at this Museum and at the Biological Survey in Washington, they proved to be either feral dogs or coyotes. The coyotes arrived in the Adirondacks as escaped animals and did not come into the region under their own power. The dogs, which seem to be predominating elements in the packs, are large animals, either police dogs, collies or shepherd types. Apparently the coyotes run with the dogs and the interesting point at issue is whether the two animals have crossed and there are now hybrids in the packs.
>
> I have examined specimens which combine the characters of these two animals and the evidence seems to be best disposed of by assuming that we do have hybrids. An argument against this is the lack of adequate observations demonstrating that the two animals actually do cross. There seems to be no doubt that the escaped coyotes in the Eastern States, lacking their own kind to run with, take up with wild dogs, and this condition has been reported from several Eastern States.
>
> I am very much interested in acquiring additional material and would be very glad indeed to have skins and skulls of any of these canines you may capture. . . .
>
> Regarding your question as to whether a dog

may be distinguished from a wolf, my reply would be that since dogs are lineal descendants of wolves, the dividing line between large, primitive type dogs and wolves is poorly defined; that is to say, there are very few characteristics to distinguish a husky dog from a pure-blooded wolf. As one encounters the highly developed breeds of dogs, there are very obvious differences which enter into consideration and it is easy to separate the dogs from the wolves. There are certain cranial characters which make it possible to separate coyotes from wolves and from their lineal descendant, the dog, but the Adirondack animals have displayed several very confusing blends of these characters, and I am glad to learn of your interest and offer to send us material which will be valuable to get at the facts. . . .

Very sincerely yours,
(Signed) H. E. ANTHONY,
Curator of Mammalogy.

Something more than dogs

Closely following Doctor Anthony's response came a letter from a kinsman of mine who is District Game Protector of Saranac Lake Division in the upper Adirondacks. Ray Burmaster always speaks his mind, and on the matter of whether these disturbers were feral dogs or not Ray had few or no doubts. His letter follows:

State of New York,
Conservation Department,
Saranac Lake, N. Y.

Dear Fred:

. . . I am not surprised . . . that you are finding some of these so-called mystery animals down there. . . .

The way it started up here is as follows: For a good many years I have received information from the natives living in the Town of Belmont in the vicinity of the headwaters of Trout River about wolves being up in there. Every once in a while some guide would come in and tell me about hearing them howl. Also I was continually receiving complaints about dogs running there and chasing the deer out of the country. On several different occasions I sent Game Protectors in there and they found where deer had been killed and eaten up. They found tracks of what they supposed to be dogs; but were never successful in catching sight of any of them.

A few years ago, an old hunter and trapper who lives on a farm which borders the forest in a locality which is known as the 'Caughlin School section' in the Town of Belmont, claimed he saw seven wolves cross his farm, traveling in a southernly direction in single file, and going towards the woods. He claimed there was a very large animal at the head. This man has hunted and trapped wolves in Canada and he impressed me as being reliable when I talked with him.

Robert Kimpton, another old guide and hunter who resides on the Salmon River about four or five miles south of Malone, attempted to raise sheep. He owns quite a lot of land at the head of Trout River . . . and he pastured his sheep on this land. However, he had so many sheep killed that he was obliged to give up the venture. Of course, we all laid it to dogs; but Kimpton was satisfied that there was something more in that section than dogs.

Wildest and slyest creatures

Ray Burmaster went on to tell how two animals were caught alive and another one was shot. But disagreement resulted as to the true identity of the predators. His letter continues:

The male looked to me exactly wolf color, and the female was redder than any red fox I had ever seen.

I then detailed some of the Game Protectors to go into a section where we know these animals were to try and snare them. I spent some time with them myself, and I do not hesitate to say that these animals are the wildest and shyest things I have ever seen or heard of. We would find where they were disturbing beaver houses. We would find fresh signs and set a few snares in that vicinity and they would never return there again. We would hunt for several days all thru that country until we found fresh signs of them in some other locality. We would make a few sets, and that would be the last we would see of them in that section. We took a sheep up in the woods and killed it, and in due time foxes, skunk, and other animals came and ate on the carcass, but never one of these animals came near it. Foxes would follow our snowshoe trail but we never saw where any of these animals came nearer than 20 or 30 feet from the trail. If they came down off the mountain, when they got near the snowshoe trail, they turned and went back, and that would be the last we would see of them in that immediate vicinity.

The Game Protectors caught a glimpse of two they happened to surprise upon a ledge on the side of the mountain, where they were feeding on a deer. The signs there showed this pair had been feeding for a considerable length of time, but after the Protectors frightened them, they did not return there again that winter.

In February, 1934, the Protectors were successful in capturing one of these animals in a snare. . . . This was examined by the Biological Survey of Washington, and after some length of time they told me that the easiest way to settle the controversy was to call them dogs. Doctor Anthony examined it and was not satisfied to agree with their decision.

That spring Robert Kimpton shot another animal that was one of three he came on to trying to get a beaver out of one of his traps. I sent that animal on to Washington and they reported that it was a dog.

Later on that spring several of these animals were killed owing to the Supervisors of Franklin

County giving a bounty of fifteen dollars each. Several men went in and trapped them. John Garland, a very good trapper, caught several puppies and Captain Broadfield kept three of them alive. . . . One died and he still has the other two. . . . No one can get near them but him. I am enclosing a snapshot of Captain Broadfield with one of these animals. He has finally been successful in breeding them and now has five puppies which are about three weeks old. In talking with him the other day, I am quite satisfied he has changed his mind somewhat as to the identity of these animals and that he has come to the conclusion that we should not overlook their importance as predators

It would seem to me that if these animals are wild dogs that we would find different color phases among them. No one ever has found one yet any other color except wolf-gray or red or roufus. . . .

Very truly yours,
(Signed) Ray L. Burmaster,
District Game Protector,
Saranac Lake Division.

We will pass over the discouraging days of the next six weeks spent in getting hounds to follow the cold trails of unaccustomed quarry.

Elusive shadows of the thicket

Hounds are very interesting and intelligent sporting dogs but none the less aggravating at times. Besides this part has been told at some length in two hunting magazines.* To summarize many winter days followed, some rewarded with chases and some without, during which the gray shadows of the thicket earned a record of crafty elusiveness.

Then, when winter was passing, there came a wet and belated fall of snow on the evening of March 8th. The story of the next day's experience is best given by a letter I wrote the next night before tumbling into bed. If you, Reader, have followed my report so far with some of the interest of the huntsman you may consider it directed to yourself instead of W. H. Foster of Boston to whom it was addressed.

. . . It is now March 9th and tonight my every stitch is draped round the big fireplace. Wet slush is the coldest thing I know of and it has been falling on my back off the Luther pines about all day. The snow we had been waiting for started last night but by morning it was more rain than snow.

I woke at the first light and was mighty pleased, as always, to see the new snow. . . . I put Ruffian and Shotgun Joe and Tug in the truck. Old Fritz clambered into the top deck and refused to budge so I left him there.

It was a dark, lowery morning and raining plenty over across the Lake. . . . Some slush still hung to the pines so that everything was adrip. But we found a wolf track and put Ruffian on where it left the roadway.

In twenty minutes Ruff was back and ready to get in the truck. It appeared *he* was *not* a wolf dog. This was a great disappointment. Ruff is our standby on bad going. But I took Joe on leash and cut a circle around the deep gully across which the track led off. It was tough going. Quite a lot of ice on the snow and it was rotten enough to break under my shoes and with Joe's chain in one hand and my gun in the other there was no chance to save myself. Besides, the pines were planted only six feet apart and, of course, their 15-year-old branches are now interlaced.

After falling headlong several times, getting the gun barrel full of snow and plenty up my sleeves and down my neck I decided to cut across the gully. That was a mistake. In the gloom I lost bearings and first I knew I was back into the highway and hadn't enclosed the wolf trail at all. I put Joe into the truck and went up to where my companion Verne was on watch. Verne suggested my taking a little path he knew of which left the highway a mile north and this I did. But when I opened the truck door Ruff jumped out and knocked me over and Tug and Joe took advantage with the result that I had only Joe on leash and Ruff and Tug gave me the laugh as they ran off in the opposite direction from where I wanted them.

Wolf scent

But, after I'd gone a couple miles over the wood path, they thought better of the escapade, and following on, overtook me out in the densest part where Tug squealed as he got a little wolf scent. Joe took the trail too and I unsnapped his leash. Ruff didn't want any wolves. And after I'd followed along another mile or two he left me in disgust and headed back toward the car.

Trailing was poor enough but we made progress. I soon lost my bearings and when the going freshened up had no idea which way we were heading. It had continued to rain. . . . My snowshoes weighed ten pounds apiece and the lacings were a mere bag. . . .

It was two hours before I found my way out of the tangle and I was a mess by that time. Even my leather hat was soaked through. My joints were stiff.

The chase had led right back at Verne. Ruff was there and had joined in, and they made the thickets ring. Chub Halloran had arrived and he and Verne had seen the wolf *five* times while he was being chivvied around the country by the three hounds. Sometimes the big gray fellow was only a few rods ahead. At others a short turn would gain him a hundred yards' lead. . . .

Shortly after I got back to the road, thoroughly wet and miserable, the chase made a bad loss. Up to that time it had been just one furious, continuous drive. The rain was just coming in straight lines and the loss looked pretty bad, though the

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**National Sportsman,* July, 1936.
Outdoor Life, August, 1936.

hounds were still hard at work on both sides the road.

I went to the truck and found a dry piece of newspaper to wipe my glasses as I had been too blind for an hour to shoot if the chance had come. I got a dry pair of gloves, caught Joe and Tug and gave them a biscuit apiece. Then Ruff came but he went on back up north searching. After resting a minute or so the heaviest rain seemed over. So, though it was late, I took the young hounds out again.

Fritz was fresh but he is pretty old and crippled. Tug was used up. He is small anyhow and had been leading through the slush breaking path. It got later and later and the only excuse we had for sticking at it was that it would soon be dark anyhow and that somewhere in that forest there was a tired wolf. We wanted him.

The Mystery Animal is run down

Suddenly Fritz let out a single squeal away up north on the sand knoll. Joe went to him, Ruff followed and they began trailing again. Another half hour and we were again lined up while the chase faded into the southwest and away from us. It had been still for fifteen minutes when I heard a few more hoots far to the west and north. It seemed about over for the day but, through force of habit, we stuck to our appointed watches. And then a gun cracked up the road.

I'd been waiting for *that* all day. Then two more shots. Then another and five minutes another. . . . On the chance that the shooting had been done at a wolf other than the one the hounds were after I drove up the road with Tug and found Verne peering into the thickets. The hounds were still over north of us. A wolf had come out to the edge of the thicket and though Verne was waiting with cocked gun, he turned on his own trail and was almost out of sight before Verne could shoot. The charge of chilled two's cut hair and bled the wolf badly.

Verne shot twice after that but the brush was very dense. Chub was down in the gully on the trail. . . . The hounds came through while Verne and I stood there, and just before they got to Chub on the blood trail we heard his rifle crack again. This time he connected. But it was still some time before he could drag the carcass up the bank and through the dense pines. Daylight was gone when he got out into the highway again. We had to call to give him his bearings.

The hounds did not shake the carcass as they would have a fox. We set the camera up in the effort to get a picture. I gave it a minute exposure but the photos are probably not much good. . . .

I could not see any resemblance to the dog intermixture supposed to be characteristic of these animals, but expect to ship the carcass down to H. E. Anthony of the American Museum, New York City, for a close examination after Verne has claimed his bounty money.

You must excuse my enthusiasm. The hound music is always very stimulating and I now realize that I had hardly expected we could really drive one of these critters ahead of the hounds long enough to kill him. We all got a big kick out of the race and its successful outcome. . . .

I think there are at least four more of these brutes down in the Luther Trees Plantation. My own opinion is that they are wolves or coyotes and that there is no interbreeding. More than that I do not believe that these things run with the cur dogs, either wild or tame dogs. Of course, there are plenty of roaming dogs and with the actual presence of wolves or coyotes and the increased killing of sheep as a result of their presence we are bound to hear some weird stories.

The bounty, too, which hearsay has it, is $5.00 for "wild dogs" and $15.00 for "wolves," will not tend to diminish the sensational stories.

This big he "wolf" hasn't *any* dog characteristics that I can see, a chubby tail, a particularly good set of teeth, a good dense coat of underfur and most of all his peculiar odor, totally unlike any dog odor. Much more like a fox but not *quite* as musky.

I hope to get some more of the younger hounds started on them. Our older ones are too well broken to enjoy transgressing. Ruff is a wonderful fox dog, but he would not take the cold trail this morning.

Another gray predator

Following the chase and kill of March 9th came other chases. On April 8th a very large animal was cold trailed and routed and viewed by myself three times as Old Fritz and Min and Ruffian noisily chivvied him about and through the dense thickets in the Luther Plantation. The next morning our enthusiasm got us out before dawn with eight hounds. After a chase which lasted perhaps eleven hours, sunset found us with another gray predator—an old female this time. The tactics employed were largely "doubling," that is, a turning back on the trail and a wide leap aside.

This summer there are still at large several of the animals in or about the Luther Plantation. If our reading of last winter's snow pages are correct there are one large and old, one small and younger male and one young female left to harry the farmer's sheep and poultry and to take a larger toll of the fawns, bunnies and perhaps of the grouse of the wilderness.

Apparently the distribution is wide.

I have no patience with the wild dog or dog-wolf theories which have obtained credence in some quarters. There is an animal that I saw occasionally in the Wyoming Country while hunting elk during the falls of 1924-25-26. We noticed their plentiful dog-like tracks in the snow and among the dense fir thickets of Andersen Creek, of the Grey Bull and of the upper Wind River. One day, in such surroundings, I caught an instant's clear, close view of a large, darkly grizzled shape. A few days later, far in the valley below, a silhouette paused at the edge of the thicket and my long, but fortunate, rifle shot laid low a light gray animal, free from any rufous tints, which I should have called a timber wolf. But Brian Sullivan (of Ned Frost's outfit, Cody, Wyoming) identified it as a timber coyote. A bit farther east and northward they call them "brush wolves."

True enough there are plenty of wild dogs in New York State and there may be crosses of them but there are also, to my personal satisfaction at least, a plenty of Simon pure "brush wolves" or "timber coyotes," not as vocal or as small as their Mexican brethren, not as fiercely dangerous as the lobo or true timber wolf.

The verdict

But you will want to know what Dr. H. E. Anthony thought of the two complete carcasses and the extra skull I sent him. Here is his latest letter but hope *not* the last (he has promised to come up to my hermit's cabin and join myself and hounds in next winter's observation of the development of the coyote situation):

AMERICAN MUSEUM OF NATURAL HISTORY,
March 23, 1936.

Dear Mr. Streever:

I received your letter of March 20th this morning and wish to thank you for donating the skin to the Museum. I had completed my examination of the skin and it was about to be returned to you, but the complete specimen constitutes a valuable and interesting record, and I am very glad to have the privilege of retaining it.

A careful examination of the skin and skull of this animal compared with coyote, wolf and dog confirms the early impression I had that your animal is a coyote. The skull is practically indistinguishable from the skulls of coyotes taken in the Western States, and although the skin, as I mentioned in my earlier letter, is not as brightly marked as most skins of coyotes, the final conclusion must be that your animal was either brought into New York by human agency or is a descendant of such an imported coyote.

Coyotes are sometimes called prairie wolves, and to the lay public there are not very many striking characters of distinction which stand in the way of considering the coyote as simply a diminutive wolf. However, there are rather fundamental differences between wolves and coyotes and the two lines of descent parted so long ago that today they are not likely to interbreed, if indeed they are genetically capable of doing so.

Boiled down, this means that we do not have wolves in New York State if by wolves one means true wolves or timber wolves. The prairie wolves or coyotes which have been brought into the State by man himself are running at liberty here and thus by a stretch of the imagination one might speak of wolf-packs in New York, although this would not be strictly true. The timber wolf, the old-time wolf of the early settlers, had a head twice as massive as the heads of these coyotes, and the body of the animal would weigh several times as much.

The skull of the animal which you cut off of the hanging carcass appears to belong to the same type of animal as the one your dogs ran down and I have considered it to be a coyote. I am glad to learn by your last letter that the skin of this animal was gray in color.

Have you or any of your friends heard these animals howl?

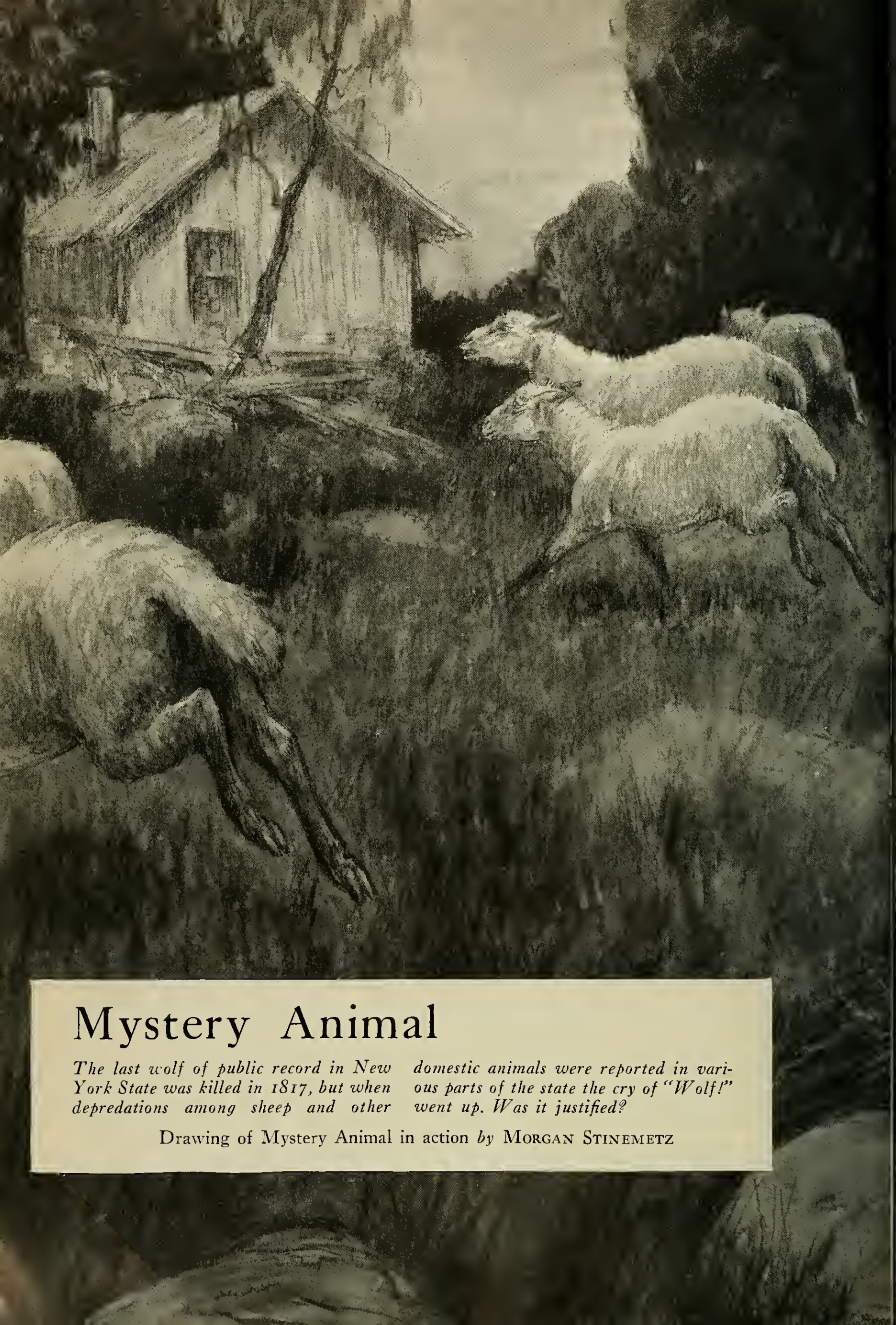
Assuring you of my appreciation of your cooperation, I remain,

Very sincerely yours,
(Signed) H. E. ANTHONY,
Curator.

Undesirable aliens

And how did they get here? Specific instances of coyote and of wolf pups bought in the west by tourists, of gasoline station menageries, and of domesticated coyotes or even wolves are not hard to find nor are such confined to any one county in the State. As in the case of most undesirable aliens among us, smuggling and subterfuge has doubtless been practiced.

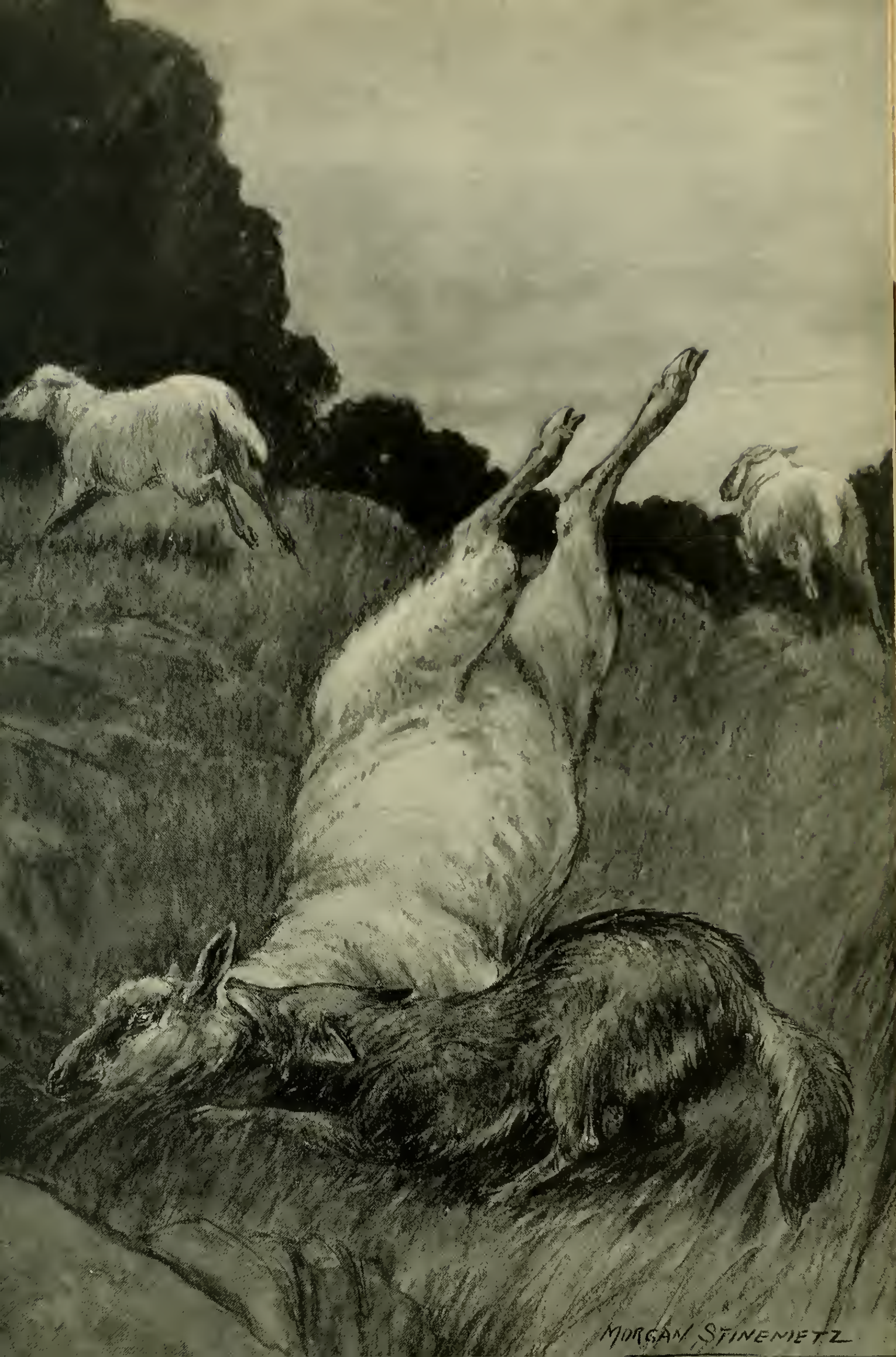
The problem is no longer when or how they got here but what or even whether we can do anything about it.

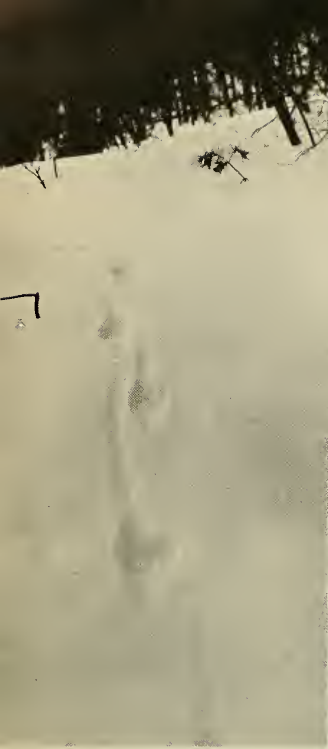


Mystery Animal

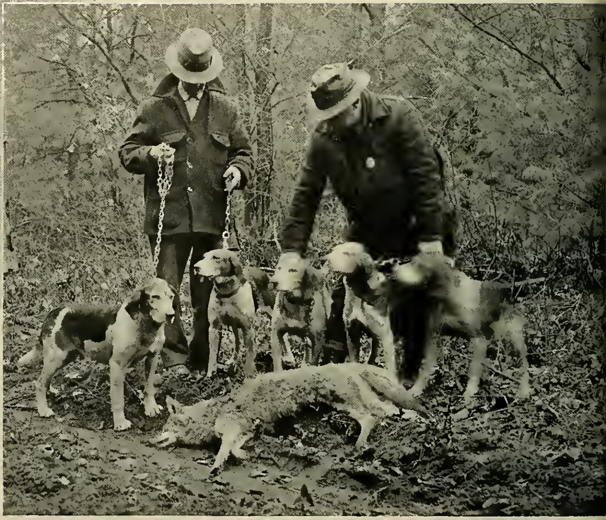
The last wolf of public record in New York State was killed in 1817, but when depredations among sheep and other domestic animals were reported in various parts of the state the cry of "Wolf!" went up. Was it justified?

Drawing of Mystery Animal in action *by* MORGAN STINEMETZ


MORGAN STINEMETZ

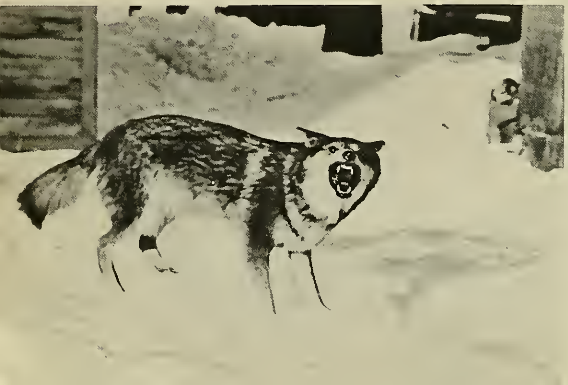


Strange tracks which strengthened the belief that there were wolves at large in New York State: prints as large as a dog's but more elongated, which threaded the densest thickets



Fred Streever Photos

(Right) The Mystery Animal brought to earth: Fred Streever (right) and his hunting partner George Cull, with the hounds which ran the culprit down

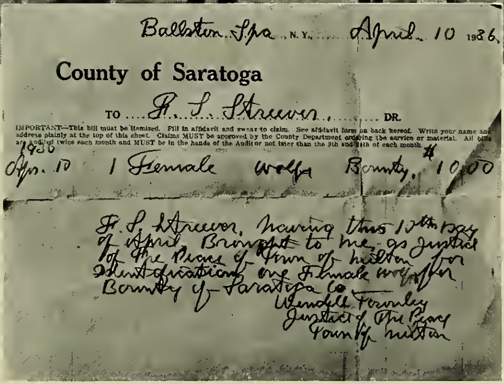


(Left) One of the gray predators, which local hunters considered a wolf: an animal trapped by Claude L. Eddy and mounted by E. P. Hotaling

Fred Streever from E. P. Hotaling

Shotgun Joe, who liked to chase "wolves." The hounds did not shake the carcass as they would have a fox

Courtesy New York Conservation Department



Ballston Spa N.Y. April 10 1936

County of Saratoga

TO F. S. Streever DR.

IMPORTANT—This bill must be itemized. Fill in affidavit and swear to claim. See affidavit form on back hereof. Write your name and address plainly at the top of this sheet. Claims MUST be approved by the County Department ordering the service or material. All bills are audited twice each month and MUST be in the hands of the Auditor not later than the 9th and 24th of each month.

1936 Apr. 10	1 Female wolf Bounty.	$10.00

F. S. Streever, having this 10th day of April, Brought to me as Justice of the Peace of Town of Milton for Identification one Female wolf for Bounty of Saratoga Co.
Wendell Townley
Justice of the Peace
Town of Milton

An animal which the Kimpton Brothers brought back alive. Men with experience in trapping wolves and coyotes in the West and Canada all pronounced this animal a young timber wolf

(Left) The animal which Fred Streever brought in to clear up the mystery was a wolf in the eyes of the law; but the Museum's verdict is that these alien animals are coyotes or "prairie wolves"

The Glamour of the Giant's Causeway

A visit to one of the most curious rock formations in the world, whose scientific explanation is less generally known but no less simple than its legendary origin

By HARRIET GEITHMANN

IT IS hard to explain why certain far corners of our precious planet capture our imagination even in childhood. The Giant's Causeway on the northeastern coast of the Emerald Isle captured mine when I was scarcely bigger than a grasshopper. Doubtless the word "giant" was the first alluring feature.

Finally when I reached Glasgow, Scotland, that same childhood whimsy took me by the hand and down the River Clyde we sailed for Londonderry and the Giant's Causeway. On that outstanding occasion it seems to me that every Scottish and Irish old-timer whom we met was exactly 70 years old and had served the public for exactly 30 years. As we glided past Kilpatrick 70-year-old Captain MacCullum who had sailed between Scotland and Ireland for 30 years, flashed us a whimsical smile with this remark:

"This is the very spot where St. Patrick, the canny Scot, was born and stepped across the Clyde after which he continued on to Ireland and chased out all the snakes and became a saint."

Off for the land of "giants"

The following morning as we churned across the River Foyle under the eyes of the Ballynagari Lighthouse and entered the harbor of Londonderry, that ancient walled-in city of Ulster, famous for its linen shirts and collars, we listened to a native daughter, Maggie O'Connell, crooning softly at the rail: "O Ireland, I'm sufferin' for you," and later, "If you are Irish come into the parlor, there's a welcome there for you."

In all directions our eyes rested on enchanting woodland glades starred with chestnut and hawthorne trees in full bloom and showers of scarlet rhododendrons. On leaving Londonderry, a rocky road flanked by snowy hawthorne hedges and ash trees shaking hands overhead, led us not to Dublin but to Portrush, the very gateway to the Causeway country, a country of fairies and giants forever in the offing. All along the way we enjoyed glimpses of country life in Ulster, clean, spotless farmhouses with whitewashed walls and thatched roofs, shelter for man and beastie. To our left glistened the blue surfaces of the Atlantic with the white surf pounding at the base of the limestone cliffs. To our right were green fields of oats starred with scarlet poppies and pastures where cows, crows and goats were content. Fragrant with the romance of the sea was each and every one of the seacoast villages through which we sped on our way. There were Ballykelly and Limavady, Bellalarna and Umbro, Castlerock and Colraine, each an Irish gem of color and simplicity. Yellow laburnums and purple lilacs, primroses, bluebells and poppies made Eglinton a poem of color. Boys and their dogs drove their cows and goats along the narrow winding streets while girls, handy with brooms, waited in the doorways ready for all emergencies. Shaggy donkeys were traveling hither and yon hauling fathers and mothers and their youngsters homeward in crude carts.

An atmosphere of Irish myths

At Portrush, a 70-year old-timer, Don Martin assured us that he had driven a taxi for 30 years and if we would but deign to ride with him he would land us at the Causeway before we had left Portrush. Don was thinking in terms of American shekels hard and fast, almost too fast. We were loath to travel with such incredible speed to make our first call on the legendary bridge of the giants, therefore we cast our lot with Joe Fisher, another 70-year old-timer, who admitted that he had been a jarvey around the hills of Portrush for 30 years. Climbing into his raggety-taggety Irish jaunting-car we jogged along easily after Billy, the bay. Cracking his whip over Billy's indifferent ears, Joe introduced us to the Skeery Isles, the haven of wild ducks and rabbits, the gleaming limestone cliffs and a promontory called the Giant's Head. Without half trying we saw the giant's huge freckled nose sniffing the salty tang of the sea, his daring goatee, his noble forehead and his green cap of moss with a button on top. The Lady's Wishing Arch reminded us that we were in the atmosphere of Irish myths. High upon a velvet bluff stood the crumbling ruins of Dunluce Castle erected ages ago with an eagle eye to a quick getaway.

The Giant's this and that

Finally, Billy, the bay, dropped us on top of a knoll in the shadow of a cluster of bleak hotels. With guides galloping at our heels offering to introduce us to the Causeway by boat, we left them and the ice cream cones far behind as we jogged down a steep and rocky trail and serenely approached the geological wonder on foot. Behind a picket fence, we found 3 spits or tongues of pillared stones slanting out into the sea, the Little Causeway, the Middle or Honeycomb and the Grand Causeway, all of them in the County Antrim on the northeastern coast of the Shamrock Isle. The very moment we dropped our sixpence and went through the turnstile another 70-year old-timer, Jimmie, pounced down upon us and like babes among the stones, we gathered that if we refused Jimmie's services, the result of 30 years of experience in guiding folk over those columns, we would be lost indeed. Therefore with Jimmie limping on ahead we trekked all over the Causeway and breathed deeply of an atmosphere of giants.

Every time we turned around we heard of the giant's this and the giant's that. Jimmie introduced us to the Giant's Horseshoe, the Giant's Honeycomb, the Giant's Cannon, the Chimney Pots, and the Keystone of the Causeway, which is the most perfect octagonal pillar; the Giant's Loom, 30 feet high; the Giant's Gateway and the Bishop's Mitre, five-sided and even all around, the most perfect pillar in the entire Causeway. The Lady's Fan, a perfect combination of five pentagons surrounded by a heptagon, all embroidered with moss, was a gem. Then we found the Giant's Organ Pipes and best of all the Giant's Wishing Chair, a regular Morris chair of stone with arms and back towards the sea. Here at Jimmie's firm command we rested in the quiet air of the giants and solemnly registered three wishes all of which will come true eventually if not sooner IF we do not tell them to anyone on earth.

Thus were we personally introduced to the most distinctive members of the great Causeway family of 40,000 polygonal stones or columns, most of which we found standing perpendicularly with but a few of them lying horizontally. Most of them were arranged in sections varying from a few inches to several feet in height, all of which are fitted together like a great mosaic, convex ends and concave ends, 15 to 20 inches in diameter. Many-sided were they, triangular, pentagonal, hexagonal, heptagonal, octagonal and the largest of all was a nine-sided column. There were but two of these large columns and both of them were embroidered with tawny lichens. Jimmie pointed out that the wide sides invariably face one another and the narrow sides do likewise. We even found a diamond-shaped pillar. With the exception of the black pillars which indicated the high-water mark, the stones were silver-gray in tone, embroidered here and there with tawny lichens and tiny pink flowers. The Causeway reflects the changing moods of the Irish sky from dawn to dusk.

How it was created

Forgetting for the moment myths and metaphors, one pauses to ask how this spectacular formation was created. Geologically the Giant's Causeway is one of the most notable examples of prismatic basaltic columns on the face of this planet. It extends like a natural pier some 300 yards along the coast of County Antrim in northern Ireland and out some 500 feet into the North Channel, and then reappears at Fingal's Cave on the Island of Staffa on the West Coast of Scotland.

Other fine examples of this same kind of formation are those scenic cliffs called the Palisades on the Hudson, the Obsidian Cliff in Yellowstone National Park, those along the Connecticut River, in the traps on the shores of Lake Superior and those walls along the majestic Columbia and the Deschutes River in Oregon.

As to the volcanic origin of this extraordinary columnar structure, authorities generally agree that during the Tertiary Period a great outpouring of basalt took place in this locality. As the molten lava was going through the process of cooling and contracting, it apparently broke up into regular sections of polygons in much the same manner as mud flats or even quantities of starch will dry and crack up into polygonal shapes when left to the mercy of the sun. It has been pointed out that the composition of the lava must have been unusually uniform. At the Giant's Causeway these polygons are strikingly regular and range from a few inches to several feet in diameter. While most of them are hexagonal, some of the columns are four, five and seven sided due to the fact that the centers of contraction were not always equally spaced. Both at the Giant's Causeway and Fingal's Cave the prismatic jointing of these basaltic columns has been developed to a high degree.

Like cordwood on end

Another principle seemingly true of this particular type of prismatic structure is that it invariably develops at right angles to the plane of cooling and resembles so much cordwood all stacked on end. This horizontal plane of cooling was not a surface layer of air but a thin formation of overlying rock which has since been removed by the agents of erosion.

The entire area of both the Counties of Antrim and Londonderry are known as the red zone, owing to the basaltic red iron ores which overlie them. These ores are the direct result of the underlying sheets of basalt, some 300 to 500 feet thick, the same igneous material out of which the Giant's Causeway was formed.

"Beyond yon point," smiled Jimmie serenely, "lies the Spanish Bay where the giants destroyed the Spanish Armada all because the soldiers dared to fire on these same limestone cliffs thinking they were fortresses. And on that rocky promontory to your left you can see the Giant's own grandmother forever struggling up hill with a sack of chicken feed on her poor old back. However long you watch, she never seems to make the summit."

In another romantic niche among the stones we found the Giant's wishing-well and Jimmie's own white-haired buxom frau biding her time on the brink, ready for thirsty and superstitious mortals with pitchers and cups. There we wished again as we slaked our thirst from the bubbling spring water and paid another sixpence as we wished. When all of these wishes come true, but that's another story.

At the crown of the bluff, waited Billy, the bay, and Joe Fisher a-top his raggety-taggety Irish jaunting-car.

"Did Billy have a good rest?" we inquired as we climbed in.

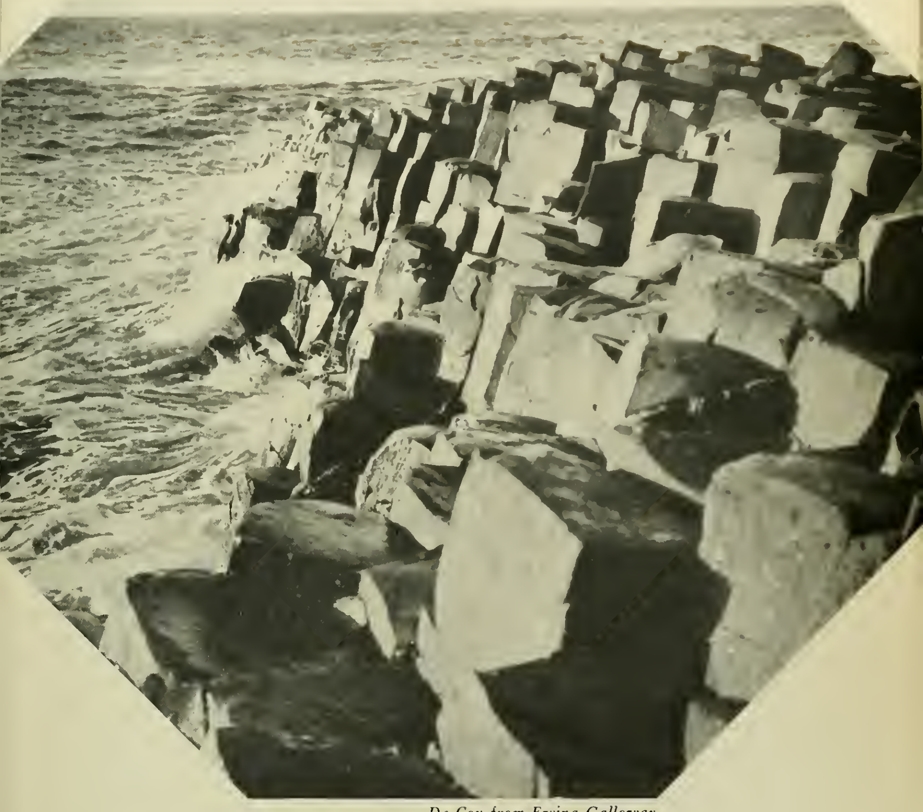
"Aye," laughed Joe, "he had a nap and a feed of corn."

More legend

Bouncing back to Portrush we learned more about the mythical Causeway. "Long before the memory of man," mused Joe, as he flicked his whip over Billy's ears, "the Giant's Causeway was created. 'Tis certain no engineer built it. Around the hills of Portrush we believe it was built by an Irish giant who had a quarrel to settle with a Scotch giant who lived across St. Patrick's Channel at Fingal's Cave. He even challenged the Scottish giant to come over and fight it out and the brawny Scot said he would be glad to accommodate his enemy IF he would build a bridge, which he did. The same formation is to be seen out at Fingal's Cave on the shores of the Staffa Islands. No one seems to know exactly who won the famous bout but we Irish have our own opinion and then there's the Causeway, this end of the Giant's bridge."

With this long speech Joe looked out over the Channel at Fingal's Cave and cracked his whip disdainfully.

Joe's legend sounded almost plausible to our American ears. We found it easy to listen to these 70-year old-timers with their 30-year-old experience along the romantic shores of the Shamrock Isle, especially in the atmosphere of the fairies and giants of the Causeway country.



De Cou from Ewing Galloway

The Giant's Causeway

A mosaic of forty thousand polygonal columns of stone comprise the Giant's Causeway, on the northeast coast of Ireland. Except where the tide reaches them, the columns are silver-gray in color, embroidered here and there with tawny lichens and tiny pink flowers.

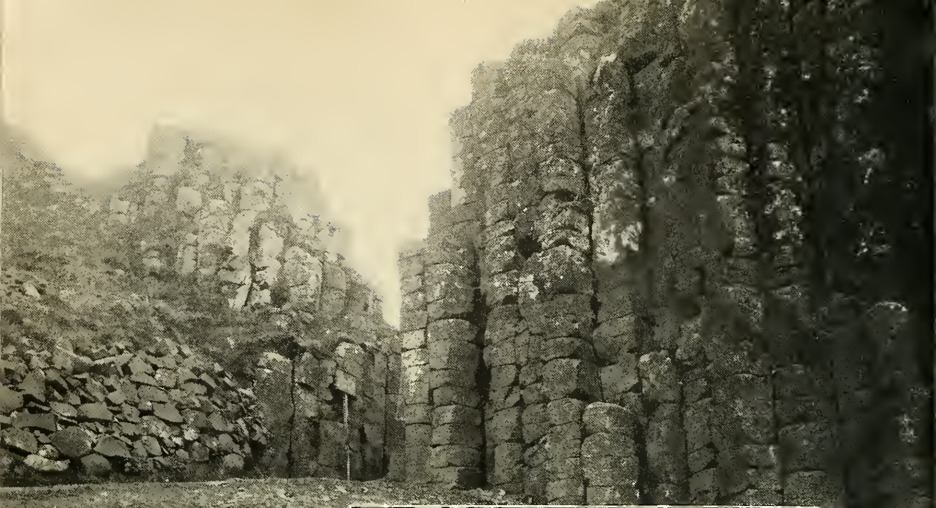
Legend has it that the Causeway was built by an Irish Giant who challenged a Scottish Giant living across the channel at Fingal's Cave, daring him to come over and settle a quarrel. The Scot is supposed to have replied that he would accommodate his enemy if he would build a bridge across—which he did. If you don't believe the story you can find the other end of the bridge at Fingal's Cave. No record revealed the quarrel's outcome

The Giant's Causeway extends like a natural pier for some 300 yards along the coast and out about 500 feet into the North Channel. It is one of the most remarkable examples of prismatic basalt columns in the world. It was formed when a great outpouring of molten rock cooled and cracked into polygonal sections, much as mud does when it dries

The columns are strikingly regular and range from a few inches in diameter to several feet

Ewing Galloway

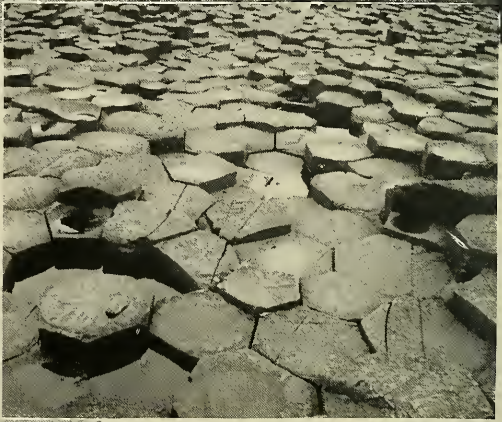
De Cou from Ewing Galloway



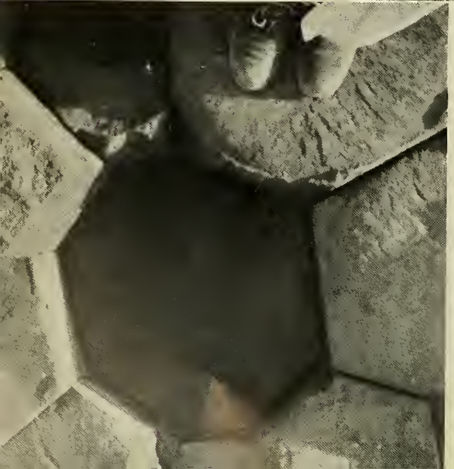
E. M. Newman from Publishers Photo Service

It is no wonder that the heavy blocks of stone which in places appear to have been put in place by human hands are attributed in legend to a giant

(Right) A honey comb in stone: a level space on the Giant's Causeway. The majority of the columns are six-sided, but as many as nine sides are sometimes to be seen



Ewing Galloway



An unusual view showing the size of the sections that make up this volcanic wonder. The sides are not equal, but it is to be noted that the figure is symmetrical, opposite edges being similar (Photo: Mrs. Branson de Cou)

Science in the Field and in the Laboratory

Total Eclipse Photographed—Trophies from Indo-China —Swordfishing—Fall Lectures.

Astronomer in Siberia: A Total Eclipse, Huge Craters

For a brief period this summer, the sun ceased to shine on a part of what once was the Russian Empire, and astronomers who had presaged the event eagerly looked forward to the discovery of additional information regarding that body.

Dr. Clyde Fisher, head of the Hayden Planetarium, had two objectives in mind when he sailed last May for the Soviet Union. His expedition called for motion pictures of a total eclipse, and an investigation into the enormous Siberian craters that had been gouged out of marshy ground in the meteoric deluge of June 30, 1908.

A recent report from Doctor Fisher states that in conjunction with Harvard's expedition under Dr. Donald Menzel, he was able to record photographically this solar phenomenon whose path of totality extended from the Mediterranean Sea to Greece and thence clear across Siberia and northern Japan to the Pacific Ocean. Camera conditions were perfect but he has not yet seen the developed film.

Doctor Fisher's efforts to attain his second objective were crowned with no such success. Only a few hundred miles from Ak-bouliak, in Kazahkstan, where the eclipse pictures were taken, lies the scene of one of the most socially calamitous, but scientifically important meteor showers in history.

Almost exactly 28 years before the occurrence of the total eclipse, 200 shellhole-like craters appeared as if by magic in about 2 miles of swampy forest. They were left in the wake of a meteoric torrent that felled and unbranched trees, shattered peasant huts, slew whole herds of reindeer, and was recorded on a seismograph at Irkutsk 900 km. away. Only one expedition, under the Russian professor, Kulik, has visited these giant craters, some of which stretch 50 yards in diameter. So it was but natural that Doctor Fisher was anxious to extend his expedition with a view to contributing further information. He was disappointed to learn, however, that an excursion to the craters was impracticable at that time.

In a late communication to Mr. Wayne Faunce, Vice-director of the American Museum, Doctor Fisher was able to give more heartening news. "The whole thing," he says, "may be affected—I am not quite sure—by the fact that the Soviet Government has planned, and financed, they say, an expedition to these craters next year. The permanent secretary of the Academy, who is one of the finest two or three Russians I have met, told me that if I wished to accompany this expedition, I would be welcomed.

"After being disappointed about the Siberian craters, I concluded to try to visit those on the Island of Saaremas (Osesel), Estonia. Estonia is straight west of Leningrad, and therefore is directly on my way back to Stockholm. I shall try to gather material about these craters for an article in NATURAL HISTORY. I feel sure they have never been visited by an American—probably by very few scientists."

D. R. B.

Fleischman-Clark Indo-China Expedition

Deep in the jungles of Indo-China Dr. James L. Clark lolled beside his expedition camp fire and listened to squadrons of elephants trumpeting in the spring night, as they trampled nearby grassy patches.

Accompanied by Major Fleischman, he had taken leave from his post as head of the department of Arts and Preparations last February to become co-leader of an expedition predicated to the collecting of museum specimens ranging from mammals like the banting, a big wild ox that resembles a handsome Jersey bull, to frogs and lizards.

Establishing headquarters at Saigon in March, the expedition headed north for a 300-mile trip into the jungle, ably guided by M. Defosse and his son Louis.

Automobiles transported the expedition to a little place called Dong-Me, where a camp and field laboratory were set up. "Two weeks spent here resulted in a fine collection of the vividly colored local birds, snakes, bats, and interesting lizards of several varieties," reports Doctor Clark.

Often plodding 12 to 15 miles a day under a scorching sun, excursions set out on foot from Dong-Me in pursuit of the banting. Several specimens were secured, including a fine bull and cow. Of these, the complete skeleton of the bull, and both skins were preserved. Fresh tiger trails were seen almost daily, and elephants, plying in all directions, left their broad, smooth trails. Integral specimens of the wild pig were also taken here.

The expedition then moved southward about 200 miles to the Lagna River where, on the broad grassy plains of this great game section, specimens of the wild water-buffalo were hunted and secured, as well as the Saladange, the hog-deer, the mouse-deer and numerous reptiles and fishes.

By this time bullock carts had replaced the automobiles, and carried food and duffle over winding bumpy trails further into the jungle. A base camp was organized on the river bank among big trees and elephant grass, where tigers more than once left their spoor a scant hundred yards away.

"Three weeks were spent in this locality building up collections until torrential rains, the beginning of the rainy season, drove us homeward to save the valuable collections already secured," says Doctor Clark. "Sizes of specimens varied from the giant water-buffalo weighing three thousand pounds to the tiny mouse-deer which weighed but four pounds. This specimen, a full-grown female, standing hardly eight inches at the shoulders with tiny hooves so small that they would hardly cover the rubber of a lead pencil, contained a fully developed foetus which by itself weighed almost half a pound. This interesting and valuable biological specimen with its entire envelope was saved as a complete formaline specimen. A large male and female elephant skull helped swell the collection, but no tiger, as the time necessary to secure this spectacular trophy would not have been justified in scientific value.

"In all, although the expedition spent only five weeks in the field, the results are most satisfactory. The preserved specimens were left in Saigon where they were packed for shipment directly to the American Museum."

Birds of the Congo and "Penguin Island"

Dr. James P. Chapin of the Department of Birds sailed for Belgium July 18th to continue work on the second volume of his "Birds of the Belgian Congo" at the Musee du Congo Belge in Tervueren.

* * *

Readers who remember Mr. Willy Ley's fascinating article *"The Great Auk"* (NATURAL HISTORY, November, 1935), telling how this flightless "north-penguin" was slaughtered into extinction, will be interested to know that on July 20, Thomas Gilliard of the Department of Birds, with Samuel K. George, succeeded in reaching Funk Island, the former metropolis of the Great Auk, thirty-four miles off Newfoundland. The absence of safe anchorage made it essential for them to embark four hours after landing. Nevertheless, they succeeded in collecting enough Great Auk bones to construct at least one complete skeleton, and in taking a census of the other birds nesting on the island.

Reconnoitering for Bisons and Antelope

On July 7th a preliminary expedition under Robert McConnell accompanied by Robert Rockewell of the Museum Department of Arts and Preparation set forth to survey the antelope herds roaming the Wyoming plains about 60 miles south of Cody. Antelopes move in scattered groups in summer and their pelage is poor. Therefore no attempts were made to take specimens. With the approach of winter, however, antelopes segregate in larger groups, are more attractively furred and offer a wider selection to the collector.

After a few days in the antelope country, Mr. McConnell inspected the semi-wild buffalo herds maintained on the National Bison Range near Missoula, Montana, by the United States Biological Survey. These buffalo are permitted to retain their natural habits, and are protected from hunters. Mr. McConnell is making necessary negotiations with the Government for permission to obtain specimens of this herd for a proposed Museum group.

Apart from its initial objective of performing the requisite groundwork for a collecting expedition this fall, Mr. McConnell's survey corps was aole to bring back with them several interesting species of birds and small mammals.

Plans are on foot to assemble a new Antelope-Bison group in the Museum's North American Hall, from specimens taken during the expedition contemplated this autumn.

Animal Life in the Rockies

Temperatures averaged 14° below zero last December, when Mr. George G. Goodwin studied wild life on the western slopes of the Rocky Mountains.

Colorado again lured the Assistant Curator of Mammals on June 19th, when he returned to the same section to continue his researches under summer conditions.

This project was made possible through the generosity of Mr. Harry Snyder of Chicago, who, with Mr. Goodwin, has made expeditions into northern and western Canada which have been recounted in NATURAL HISTORY (September, 1935, and May, 1936).

Swordfishing in Nova Scotia

Through the generosity of Mr. Michael Lerner, an expedition to the swordfishing grounds off Cape Breton, Nova Scotia, left New York on July 25th, under the auspices of the American Museum of Natural History.

The personnel of the expedition consisted of: Michael Lerner, John Treadwell Nichols, Curator of Recent Fishes; Francesca LaMonte, Associate Curator of Ichthyology; Harry C. Raven, Associate Curator of Comparative Anatomy; Miles Conrad, Assisant Curator of Comparative Anatomy; Ludwig Ferraglio of the Department of Preparation and Exhibition; and Anthony Keasbey of the Department of Ichthyology.

The Nova Scotian Government placed a large boat at the disposal of the expedition for collecting up and down the coast and adjacent islands, and also supplied a motion picture operator. During the last part of their stay, the expedition moved down to Wedgeport, Nova Scotia, for the big tuna run off Soldier's Rip, where it collected data for exhibit material in the Museum. A laboratory has been established at Louisburg for studies of the anatomy, food habits, and other data on the fishes of the region, particularly the swordfish.

Planetarium News

During the month of September the lecture in the Hayden Planetarium will be on the subject TIME AND NAVIGATION, including discussion of such points as time-keeping of the ancients, time and space, the elementary fundamentals of navigation, and the sky as a time-keeper, with discussion of the various kinds of time. During September there is to be in the Planetarium an exhibit of ancient and fine timepieces. The watch used by Lincoln Ellsworth at the South Pole will also remain on exhibition on the second floor of the building.

During September, on clear Tuesday evenings, a telescope will be available outside the Planetarium after the eight and the nine o'clock lectures for Planetarium visitors. The moon, the planets, and various other interesting sky objects will be viewed at these times.

Radio talks under the auspices of the Amateur Astronomers Association will continue over Station WHN, on Friday nights from 7:30 to 7:45.

The regular meetings of the Amateur Astronomers Association and the Junior Astronomy Club will commence again for the year 1936-37 early in October.

During September Jupiter is a bright object in the evening sky, setting about four hours after the sun. Saturn comes into the sky about sunset by the middle of the month and is in view all night. At this time it is at its maximum brightness for the whole year, magnitude 0.8.

Education Notes

During the last three weeks of July there was an exhibition in Education Hall of 52 water-colors of Panama's fruits and flowers by Mrs. Marie Louise Evans of Balboa Heights, Canal Zone.

An exhibition of the work done last summer in activity programs by children who attended the summer play schools and day camps of WPA 1563, under the supervision of the Board of Education, will be on view from Sept. 21st to Oct. 15th.

During July and August the Department of Education instructors accommodated about 5,000 children from the Play Schools of New York City. These youngsters were given an hour's instruction in the halls and an hour of motion pictures.

On July 13th, 20th and August 3rd three groups of young students from Germany totaling 125, were conducted through the Museum by special guides. Every year under the auspices of the West Side Y. M. C. A. groups of this type have been coming to the United States.

Lectures

The American Museum of Natural History, through its Department of Education, will again offer a number of courses in cooperation with the colleges and universities of the city.

Free Courses for Teachers: *Methods of Teaching Geography* in an Activity Program by Mrs. Grace Fisher Ramsey; *The Museum in Elementary Social Studies* by Mrs. Ramsey; *Nature Study for City Teachers* by Miss Farida A. Wiley.

A new offering to teachers of New York City public schools is a course *Craft Techniques,* including Miniature Habitat Group Making, Finger Painting, and Nature and Geography Crafts. The brevity of the course does not permit the granting of alertness or college credit for the work.

Pay courses in Astronomy, by Dr. Clyde Fisher, will be offered by Hunter College and New York University. College or university credit will be allowed for all these courses, as well as alertness credit by the Board of Education.

The regular lecture courses for classes of public school children will be continued, including auditorium lectures for elementary school pupils, lectures in biologic science for high school biology students, exhibition hall talks, sight conservation talks, and specially arranged lectures and demonstrations in the Hayden Planetarium.

Free Saturday afternoon programs of educational motion pictures will be given for the general public at two P. M., beginning September 19th. At four P. M. on four consecutive Saturdays, starting October 24th, Mr. Herbert P. Whitlock will give a free talk on *The Appreiation of Gems,* including jade and amber.

Oceanic Birds of South America

Twelve hundred copies of Dr. Robert Cushman Murphey's two-volume work of this title were issued, after which the type was destroyed. At the date of issue of this number of Natural History less than one-third of the edition remains in stock. In all parts of the world the work has been received most favorably and has been awarded praise by bibliophiles as an extraordinarily fine example of printing, illustration, and format, no less than by scientific men for the excellence of its plan and text.

NOTE

An error occurred in regard to the volume and issue number on the binding of the June NATURAL HISTORY. The designation should be volume XXXVIII, No. 1, and subscribers who intend to bind the magazines are notified that the June issue should be placed at the beginning of the second volume of 1936 rather than at the end of the first volume as the erroneous figure might suggest.

Acknowledgment

Owing to an ambiguity in the official records credit was not correctly given in the January (1936) issue of Natural History for the procuring of the young bull elephant in the Akeley group. Opportunity is taken at this time to state that this animal was collected by Mrs. Delia J. Akeley.

RECENTLY ELECTED MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

Honorary Life Member

Mr. James Zetek.

Life Member

Mrs. William F. Sanford.

Sustaining Members

Mrs. William H. Good

Messrs. W. K. Kellogg, Noel Robinson, F. S. Streever.

Annual Members

Mesdames Harold Amory, Grenville Clark, Jessie Benedict Faye, Meredith Hare, Herbert Du Puy, James J. Lee, O. L. Loring, Richard H. Mandel, Howard E. Perry, William Clement Scott, I. De Ver Warner, Sylvan E. Weil, Frieda B. Winner, Richard W. Woolworth.

Princess Xenia of Russia.

Misses Ethelwyn Doolittle, Elisabeth Harris, Anne S. Richardson, Anna L. Slater.

Reverend John F. Ross.

Doctors Afranio do Amaral, John V. N. Dorr, Frances Holden, Robert L. Levy, Madge C. L. McGuinness.

Honorable James A. Fitz-gerald.

Messrs. Joseph Adams, Malcolm P. Aldrich, Charles L. Allen, Elliot S. Benedict, J. L. Berston, Corwin Black, Elmer G. Diefenbach, Joseph L. Fleming, E. F. B. Fries, Alfred Henry Friedman, William J. German, Alan Hazeltine, Carl T. Keller, Robert Meyer, George Oenslager, Rushmore Patterson, Stephen Peabody, Max Rosenwald, William H. Schroder, Lester S. Thompson, William Richard Townley, R. Alan Turner, Clark Williams, Dudley F. Wolfe.

Associate Members

Mesdames R. A. Arnold, Moses Ascher, Donald S. Barrows, Charles Bovey, Miller Brennan, Anna B. Claster, John Winchester Dana, Leon A. Dodge, Septa L. Dooley, Stella J. Ernat, Charles N. Felton, Leonard Freeman, Edward G. Gardiner, E. H. Gipson, W. T. Haines, Allen K. Hamilton, May D. Hausling, E. K. Hebden, Albert E. Heller, John Eric Hill, Geo. Hillyer, N. S. Hopkins, Wm. H. Hyde, Francis Nash Iglehart, Frederick C. Johnson, George K. Kaiser, Dorthy M. Kelley, Edmund Key, Jr., Helga Larsen, Eldon Macleod, B. F. Myers, Jean L. Naylor, William C. Parnell, John W. Price, Jr., G. W. Prior, M. G. Stewart, Walter M. Taussig, J. F. Terriberry, Geo. E. Twiggar, Caroline M. VanBrunt, H. L. Walcutt, C. C. Walker, William S. Wandel, C. Raymond Weaver, Sydney Webber, A. U. Whitson, Nancy L. Wolverton, Franz F. Ziegler, C. T. Zoebisch.

Misses Ella Vollstidt Allen, Dorothy Arnett, Peggy Atlas, Mabel A. Barkley, Barbara Bassett, Sophie F. Baylor, Ida T. Bixby, Beatrice J. Brady, Lilla M. Brown, N. Margaret Campbell, Ellen J. Collins, Jean Crager, Marian Crocetti, Minna Durschnitt, Esther Gellman, Betty Hall, Mae Hatfield, Catherine D. Hauberg, Orpha M. Hayes, Ottilie Margaret Heil, Helen V. Hofmann, Beatrice I'Anson, Isobel Julien, Ida K. Langman, Emma H. Loomis, Anna Looser, Veronica MacEwen, Margaret Macfarland, Ann McDiarmid, Julia W. McIntrye, Maria M. Morrow, Dorothy Morse, Margaret L. Murphy, Mildred S. Narins, E. Virginia Orr, C. H. Ouwerkerk, Harriet T. Parsons, Inez K. Payne, Mae Belle Peck, Rachel Pitman, Margaret Rhodes, Margaret Roderwig, Helen C. Rogers, Alice G. Sanders, Elizabeth L. Sawyer, Anne Sherman, Elizabeth J. Sherrett, Jean Smith, Anna L. Sommer, Edna J. Sperry, Elizabeth H. Vanneman, Sally Welsh, E. E. Whitney, Marianne Wolff, Caroline R. Woolley, Vera Zeip.

Reverends Charles Graves, William B. Hays, A. P. Kashevaroff, Charles E. Lillis, Harold Pattison, Eliot White.

Colonel James Perrine Barney.

Lieut. Comdr. Walter M. Wynne.

Major H. W. Lockett.

Doctors Clairette P. Armstrong, Wm. H. Bickley, Walter H. Brattain, G. B. Capito, M. D. Cramer, Nathan Smith Davis 3rd, Charles Edwin Galloway, Rudolf Geigy-Heese, Aldis A. Johnson, Paul Klemperer, H. A. Krieger, F. W. Lee, J. M. Martin, Lyle G. McNeile, M. R. Newcomb, Hugo O. Olsen, George C. Paffenbarger, Harlan Page, B. W. Rhamy, Philip Q. Roche, Heinz Schmid, Geo. P. Sims, Alva Sowers, Clarence B. Tanner, H. M. Tolleson.

Professors George B. Barbour, A. M. Popov.

Messrs. George F. Abderholden, Sumner Abramson, H. Laurence Achilles, John G. Alioto, Charles W. Allen, Henry Butler Allen, Henry M. Allen, Sloan Allen, Oscar P. Allert, James Anderson, O. J. Anderson, Edward Appel, W. H. Austin, Malcolm B. Ayres, W. M. Bailey, A. H. Baku, Ezra James Barker, E. Munroe Bates, Herman T. Beck, Ralph L. Blaikie, Emanuel Blumstein, W. Boaz, Norris Myles Brown, Joseph Bruchac, Frank Bruen, Ben B. Cain, Barton Haxall Cameron, J. L. Camp, Donald B. Clark, A. W. Cooms, Fox B. Conner, Thomas B. Cornell, W. H. Cowles, T. E. Curran, Glenn Daun, Arnold G. Davids, Gudmundur Davidsson, George M. Demm, Robert A. DeWolf, Charlemagne Tower Drew, Allan A. Drimie, L. C. Elrod, Winston Elting, Paul Favour, Peter Foote, M. H. Forster, Ira Garfunkel, S. M. Gloyd, David Gramkow, Morris A. Greenwald, Howard Gresmer, Eugene Grimaldi, Herman E. Halland Jr., Robert J. Hamershlag, John W. Hammond, Frank Hankin, Robert M. Harris, Walter Hastings, Geo. L. Havemeyer, Ken L. Henderson, B. N. Hendricks, F. Whitehill Hinkel, Henry Charles Hoar, Abe Hoffman, J. H. Howard, Ralph E. Hubbard, C. R. Hudson, Alfred Huse, James Jackson, A. K. Jenkins, E. Kenneth Jenkins, Parks Johnson, Peter Jordanoff, C. Fred Joy Jr., Wm. J. Kihn, Nandlal Kilachand, Samuel R. King, Robert Marvin Krassner, Alexander Kreithen, Ralph G. Krieger, Thomas K. Lazure, Derek Thayer Lees-Smith, H. Grant Leonard, Roger G. Leonard, Alan M. Limburg, George West Liskow, William R. Lodge, Duncan Longcope, Alberto Martin Lynch, Jacob L. Markel, George T. Marsh, Ralph C. McConnell, John M. S. McDonald, James R. R. McEwen, John A. McGregor, Floyd J. Miller, W. A. Mitchell, J. E. Moore, George S. Munson, John M. Murray, Walter P. Muther, Karl Erik Nasmark, Herbert L. Nichols Jr., T. H. O'Brien, E. Ospina-Racines, Watson Parker, LeRoy W. Parsons, Southwick Phelps, Edwin T. Phillips, Fred J. Pierce, Walter G. Pomering, Kennett F. Potter, Fred J. Raffelson, Homer F. Rensch, Lee W. Reynolds, Royal P. Richardson, F. H. Rivers, W. B. Roberts, P. H Robertson, Edmund B. Rogers, Morrison Rogers, George Bowyer Rossbach, F. A. Schaff, F. S. Selby, David Rives Sigourney, Elihu A. Silver, E. J. Simonek, Berry Cushing Smith, Earl E. Smith, Lee Smits, Albert H. Sonn, E. B. Sprague, Guy H. Stanton, Theo. E. Stebbins, Henry H. Stickney, Otto Stoll, John H. Storer, Hans Ris Studphil, Irving Stutz, Richard C. Sullivan, John A. Sutro, G. Arthur Swan, C. G. Teitsch, Ben H. Thompson, H. R. Turner, George H. P. Van Alst, Bernard Van Ingen Jr., Walker Van Riper, J. Varley, Howard H. Warner Jr., Wm. H. Welsh, Harry Sylvester Wender, Fred G. Whaler, George W. Wheelwright, Lawrence Whitcomb, Charles L. Williams, Murphy M. Williams, Wm. W. Wood, J. H. Woods Jr., W. D. Craig Wright, Christian C. Zillman Jr.

Frank Richard Oastler

HUNDREDS of men and women in this city and throughout America are mourning the passing of Dr. Frank Richard Oastler. A grandson of Sir Daniel MacNee, one time President of the Royal Academy of Edinboro and a great grandson of Sir Richard Oastler, he achieved distinction as a physician and surgeon and for many years was chief surgeon of the Lenox Hill Hospital and professor of surgery in the College of Physicians and Surgeons of Columbia University. Men and women in all works of life will long remember his professional skill and they will treasure equally his great spiritual qualities which led him to a sympathetic understanding of the serious problems of their personal lives. When he had given to his patients from the best of his medical knowledge and experience he still had much in reserve for them. Not unlike the Great Healer, he sustained those who depended upon him by the very essence of his own spiritual life. No one ever left his counsels without a stronger faith in themselves, a better hope for the future and a firmer belief in the goodness of life.

Unless one knew of the personal life of Doctor Oastler he might well wonder at the man's incredible vigor, his boundless optimism and his astonishing youth. When still a young man and realizing the need for a balance to offset the rigors of his professional life, he sought and found refreshment for his mind and body and sanctuary for his soul in the wildest and most beautiful mountains of the West. Each summer for more than a quarter of a century he spent three or four months traveling by pack train along the great rivers, over the flower-filled alp-lands and across the great glaciers and high passes of the American and Canadian Rockies. In the course of time he and his wilderness-loving wife came to know almost every peaceful valley, deep canyon and rugged peak along the Great Divide between the Colorado and the Yukon. All these natural beauties of landscape and the wild creatures of the rocks and the forests he photographed and he became a master of the photographic art. The rare trumpeter swan at nesting time along the shallows of some mountain lake; the big horn sheep in his high fortress among the cliffs; the beaver busy in the construction of his river home; the woodland caribou, the moose, the elk, ranging amid dark forests of spruce and balsam—all these and a host of lesser creatures became his friends. Thousands of feet of film and colored slides of wild life and virgin country were his dearest treasures—and even more, the memory of the wilderness which they recalled. Using his film and slides in his lectures for charity, he raised large sums for the alleviation of human suffering.

Ardently opposed to the hunting and killing of animals for sport, he fathered the conservation of the wilds and was primarily responsible for the creation of several of our National Parks. This great nature lover "lifted up his eyes unto the hills" and drank deep of their streams of inspiration.

—MARY L. JOBE AKELEY

Your New Books *by D. R. Barton*

Men of Science—Island Lore—Jungle Nights—The Sky—A Lonesome Drum

TRAIL BLAZERS OF SCIENCE

- - - - - by Martin Gumpert

Funk & Wagnalls, $2.50

"In the service of nascent truth . . .
Men die, are executed, tortured . . .
But the Idea is immortal."

"TRAIL Blazers of Science" is a magnificent tribute to the tenacity of the human organism in the face of every conceivable physical torture and spiritual mortification. It first appeared in Germany under the title of "Das Leben Fur Die Idee." Mr. Edwin Schuman has given a faithful and gifted translation whose sensational title may be defended on the grounds that the book's message will reach a larger audience.

With the following words the author epitomizes the great, sad, *Leitmotif* that recurs with Wagnerian solemnity throughout the pages of his book:

"The world allows itself to be converted to its true forward steps only reluctantly. Animals take fright suddenly and become accustomed slowly. *Mischief has another, quicker dynamic than benefaction.* The good deed lacks the moment of terror with which the evil deed paralyzes the understanding and enthralls the heart. Out of this difference is born the world's unrighteousness."

It is a sickening tragedy of human existence, that the men whose brains propel the very lifestream of our civilization, must, in the name of precedent, be bodily and spiritually crucified by blundering contemporaries. The author's task is to tell of the lives of certain heroes of world and scientific history in such a way that they become the protagonists of progress in "the bitter warfare between myth and knowledge." Laity will be unfamiliar with many of their names—but the task is admirably fulfilled. Doctor Gumpert is articulate to the point of artistry, as well as being a sound scholar and an able scientist.

The heroes are grouped according to the centuries in which they lived. Starting with the 16th, there are Cardan, Vesalius and Servetus, all more or less brutally victimized by religious intolerance.

In the 17th Copernicus and Kepler investigate the heavens, and Swammerdam, the world of insects. The dawn of man's evolution is discovered by Wolff and LaMark in the 18th. Robert Mayer is confined in an asylum for the insane because he published the law of the conservation of energy; Jackson and Morton fight bitterly for the credit of discovering ether anesthesia, and Von Pettenkofer lays the foundations of modern hygiene, in the 19th.

Despite Dr. Harvey Cushing's incontestable brilliance, and the great benefits his work has undoubtedly bestowed on mankind, your reviewer deplores the author's selection of him as the hero of the 20th century. This great brain surgeon does not seem to be the rightful heir to the crown of pain that passed inexorably from one to the other of the preceding heroes. Doctor Cushing saw little of the bitter opposition, and downright oppression of his illustrious forebears. True, he was scoffed at—but he was not expatriated, strait-jacketed, or burned at the stake. Encouraging though this may seem, it lends a note of false security to the facility of progress in our own times.

For, all too often, dark forewarnings of a growing reaction against intellectual achievement are filtering into current news reports. Organizations at Doctor Gumpert's doorstep are carrying out programs of religious persecution which have discriminated against some of the world's most enlightened minds.

No. The human race has not yet learned to detect its benefactors. Mischief has still "another, quicker dynamic"—and all is not well.

You feel somehow, that the 20th century held out a challenge to Doctor Gumpert, before which he faltered. It is not denied that the difficulties of fact-gathering would be enormous and the risks, tremendous. Then, too, he would probably suffer the very indignities and griefs he so righteously laments in the lives of his heroes. There would be a curious justice in that—but one, Doctor Gumpert does not wish to contend or explore. Because of this, his life will be, perhaps, simpler and happier—his book, truly brilliant—not truly great.

THROUGH THE TELESCOPE

- - - - - - - by Edward A. Fath

McGraw-Hill Book Co., Inc., $2.75

NO doubt there are many admirable books for the beginner in Astronomy, and for those whose interest is merely casual. But this is certainly one of them.

Since Edward A. Fath, who is professor of astronomy in Carleton College, is the author also of an excellent textbook of astronomy—a standard, somewhat technical work—his credentials are in order.

Through the Telescope, however, is anything but technical. It is eminently for the layman. Professor Fath points out that he wished to include no more than could be read in one evening by a reasonably rapid reader. In this he has succeeded, for his style allows of swift and pleasant reading. It is friendly and easy, though never careless; light, almost breezy. One finds a minimum of "science" and a maximum of what is curious, and essential, and human in astronomy.

The book is amply illustrated with well chosen drawings and photographs.

The reader is taken, in imagination, on a journey to two great observatories, the Lick and Mt. Wilson. Through the giant telescopes there he makes his acquaintance, evening after evening, with one celestial character after another—a novel way of making first contact with the sky, and a good one.

The writer points out later, in speaking of a minor planet, "It would be impossible to have a baseball game on the asteroid, for every long hit would drive the ball off the asteroid altogether. The ball would never return but would swing around in space as a separate minute planet in an orbit around the sun."

Significantly, Professor Fath sub-titles his book, "A Story of Astronomy." It does not pretend to be *the* complete story of astronomy. Many such stories must be written before the tale would be fully told. But as *a* story it is heartily recommended.

—ARTHUR DRAPER

GREEN LAURELS

- - - - - - - by Donald Culcross Peattie

Simon and Schuster, $3.75

"The living world as you came to it with the ardor of first love."

THAT lush style of Mr. Peattie's, so fragrant, so plump with adjectives, will whip city-dulled sensibilities to a tingling new awareness of Nature, will open the eyes of the young novice, will strike tremulous chords of emotional recognition in the sensitive soul.

Skeletally, "Green Laurels" is a mere collection of biographies. But the body of the book, the central theme, is "man's mind as it is concerned with Nature."

Mr. Peattie begins with the Medieval herbalists—and their first tiny emergence from the dusty gloom of ever-reiterated Aristotle. The progress of Malpighi, Swammerdam and Leeuwenhoeck is deftly traced. Then on to the decadent court intrigues of the pouting Pompadour, and the part she played in the lamentable feud between Buffon and Reaumur.

He tells how the green world unfolded under the nordic eyes of Linneaeus; how LaMarck lived, learned, and died, and of Cuvier's opposition to him.

Swiftly, then, the book turns to that vast laboratory of the Naturalist—the New World. How Michaux and Bartram, the wilderness plantsmen, fared therein, and how Wilson and Audubon studied and sketched under harsh difficulties.

Comes the bizarre career of Rafinesque, and that of the hopelessly impractical Thomas Say.

Back in Europe, he toys amusedly with the "rose-water teleology" of Goethe and the Romanticists. Thence to Darwin, and Wallace and the familiar tale of the world's reception of the evolutionary theory.

Jean Henri Fabre is his last figure. Lovingly the author extols the courage and fortitude displayed by the naive, little Frenchman in his devotion to the cause, amid the most depressing domestic heartbreak.

That its author discloses nothing the practising Naturalist could add to his store of information is not to be deplored. It is enough that the book should stimulate an interest in those spiritual rewards to be won by intelligent contemplation of plant, bird, and animal life in all its infinite variety. Science must have its popular apostles. And Mr. Peattie might perhaps be styled as ace "contact man" for botany and ornithology.

HARPOONER - - - - by Robert Ferguson

Univ. of Pennsylvania Press, $2.50

"Large oyster shells as big as wheelbarrows"

SIMPLICITY with the ring of truth fills the pages of this whaler's diary making of it a vital document on a now vanished way of life.

Mr. Leslie Dalrymple Stair's editing is to be commended for its admirable restraint in preserving intact the impressions and activities of Robert Ferguson as they were actually recorded during his voyage on the ship *Kathleen* from 1880 to 1884.

A python's gaping jaws, the horror of an Arab slave market, brawls on shore and at sea—all these and much more he describes in addition to the authentic technique of his precarious profession.

Almost automatically, one calls to mind Richard Henry Dana's "Two Years Before the Mast." But Ferguson is no Harvard man (his formal education ended at the age of 9) and his prose is as free of the polished rhetoric of that classic as it is of the mysticism of Melville.

It is curious indeed, that this simple, God-fearing seaman should achieve fine literary effects by a style whose verbal economy so markedly resembles the studied medium of certain noted writers of our own day.

"AN ODYSSEY OF THE ISLANDS"

- - - - - - - by Carl N. Taylor

Scribner's, $3.00

"No sounds . . . save the splash of fish or crocodiles, the sucking of stealthily moving feet in the mud, and an occasional cry of some raucous, night-flying bird."

MR. TAYLOR gave up a job in the university of the Phillipines at Manila with the idea of devoting a month to arduous travel through the islands lying beyond the scope of the white man's civilization. His odyssey lasted more than a year.

At once a story of high adventure and an unflattering commentary on the arbitrary attempts to superimpose one culture upon another, it is narrated with surpassing skill and a certain masculine charm.

Readers who prefer their explorations untainted by sensationalism will not be disappointed in the author's treatment. He was determined to write an utterly honest report of human life as it exists in the little-visited sections of the Phillipine archipelago, and, undaunted by danger, hardships or fever, has achieved a well-deserved success.

Starting from the southernmost end of the islands, his odyssey took him, by devious out-of-the-way paths, to the extremities of Luzon in the northeast. In its course, he joined in the almost Neanderthal hunts of the pygmy Negritoes, was "cured" of dysentery by the weird contortions of a Sea-Gypsy Medicine Man, sought gold in the domains of chronic head-hunters, and most impressive of all, saw minor civilizations, drifting, before his very eyes, toward inevitable extinction.

His camera was always with him, and the abundant original photographs are worthy companions of the text.

Mr. Taylor has few panegyrics for the civilizing processes contrived either by the Spanish or the United States governments. He says, at one point, "I was trying to think of some blessing that the Government had bestowed upon these people who had gotten along and prospered for forty centuries by their own efforts." He ridicules the absurdity of teaching children of the indomitable Morro outlaws to reverence "a pale little boy with a hatchet ... who was not ingenious enough to tell a necessary lie, a trait of character foreign to the oriental nature, which not even their Christian teacher can understand."

The author is not a confirmed opponent of every well-intentioned, albeit clumsy, effort of the Phillipine administration to "improve" the natives. His is simply a plea for a truly enlightened program. It is a curious justice that permitted the author, in a sense the patron of subject peoples, to die last February, by the hand of his houseboy, while at work on an investigation into the rites of the Penitentes in New Mexico.

HOW TO USE YOUR MINIATURE CAMERA

- - - - - - - - - by Ivan Dmitri

The Studio Publications, N. Y.

TO the person contemplating the purchase of a Leica miniature camera, or to the recent owner of the same instrument this book makes a valuable starting point. The opening pages are devoted to a minute discussion of the mechanical operation of the Leica. The instructions go so far into the taking of pictures as to show the effect of each of the various lenses obtainable.

Perhaps the most valuable part of the book lies in the second part that contains the illustrations. It is here that the beginner starts to appreciate the field of the miniature camera in catching "life on the wing." The unposed "candid" photographs of animals and babies as well as unusual speed shots of performers on the stage display the wide variety of subject matter open to the miniature camera enthusiast. Exposure data and information of interest about unusual conditions under which the picture was made are given for each picture so as to help improve the judgment of the miniature camera user when confronted with a difficult subject.

—CHARLES H. COLES

DESOLATE MARCHES by L. M. Nesbitt

Harcourt Brace, $2.50

". . . read the tale in my ragged clothing and bleeding hands and my unquenchable thirst."

PESTILENTIAL flies that lay sight-destroying eggs in the corner of the human eye, myriad ticks that bore and feed in the skin, vampires that suck the blood of sleeping victims, these and many other spawn of the Venezuelan jungle make "Desolate Marches" a well-named book.

An untimely Alpine death has cut short the promising career of its author, L. M. Nesbitt, engineer, traveler, adventurer—and above all a writer so gifted as to merit comparison with W. H. Hudson. No more, will he plod, stricken with fever and dysentery, behind the swinging machetes of his trail-breakers. He has surveyed his last wilderness, written his last book, and a noble mind has passed from among us.

"Desolate Marches" is a worthy legacy.

Frankly autobiographical, it is the story of his surveying expedition in the region of the Orinoco basin. On this framework is woven an unforgetable display of the frightful squalor and degeneracy of the natives, together with a few vagrant whites, who, forsaken by their own civilization, sink likewise to the brute level, crushed by the invincible jungle.

The prevailing grimness is, however, not unrelieved. Here and there he comes upon an amusing or admirable being—and his descriptions of the natural surroundings are eminently beautiful. He makes pets of many of the animals and birds, and despite his sufferings and discomforts, expresses, at the end, a genuine regret to leave the verdant wasteland that held so great a fascination for him.

CHILE: LAND AND SOCIETY

- - - by George McCutchen McBride

American Geographical Society, $4.00

". . . a New World Country with the social organization of old Spain; a 20th century people still preserving a feudal society . . ."

MR. McBRIDE'S impressively documented yet readable volume is an impartial and scholarly analysis of the vast social problems facing the Chile of today.

Chile has its grandees—*hacendados* they are called, most of whom trace their ancestry back to the original holders of the *encomiendas* (land grants from the crown during the colonization period). So deeply entrenched is their hereditary position of ownership, that a Chilean authority has declared: "In Chile there exists a greater monopolization of the agricultural land than in any other country of the world."

The soldier forefathers of the *hacendados* wrested the country from the Indians, settled on large royal grants, and remorselessly forced the conquered people into vassalage. So began this long dynasty of overlords. Indeed one may describe Chile's history as the history of its *hacienda.*

Each *hacienda* is a remarkably self-sufficient unit. It has its own blacksmith, wet nurse, seamstress or veterinary, and its store sells tobacco and light wines to the laborers. The latter have often lived all their lives on the *hacienda,* as had their fathers before them. They are between 75-90% illiterate and until this generation it has not been attempted to make them otherwise. All opportunities for education and culture are open only to the *hacendado* and his family.

At the outset of the twentieth century this two-class system of "Master and Man" began to disintegrate. Periodic need for workers in the mines and nitrate fields, and other causes created a class of nomad laborers, who go about the country selling their labor power. A third estate of small farmers, and a few isolated, collectively owned communities arose. Lastly, due to increased exports, room for industrial labor was effected.

It thus became increasingly apparent that the *hacienda* system had outlived its usefulness.

Mr. McBride traces the stormy history of Chile's politics; shows how in every crisis, the *hacendados'* interests gave ground only grudgingly—and concludes that there is a very real danger of their losing all their lands, if they do not consent to the equitable redistribution of part of them.

The book is by no means exclusively a compendium of the economic history of Chile. Its author writes admirably of the people themselves, of his personal contacts with them and their work. He tells of the land they live in; its sprawling mountain ranges, teeming forests, and varied climate. He supports his text with a large number of interesting photographs and maps, that enable the reader to gain a vivid picture of a turbulent and colorful nation.

HOW ANIMALS DEVELOP

- - - - - - - - - by C. H. Waddington

Norton, $2.00

HERETOFORE, the embryologist has concerned himself with the problem of observing and recording with descriptive accuracy each phase of embryonic growth and differentiation. Mr. Waddington centers his discussion in the as yet unsolved problem of what makes animal tissues develop and integrate as they do.

The most striking discovery brought to the reader's attention is that of the apparent existence of one or more "organization centres" within the tissues, determining the character of the specialized organs which become differentiated in the individual. Mr. Waddington cites as an example that when frog's skin is grafted experimentally into the mouth of a newt, it becomes induced to form a mouth, apparently due to the presence of an "organizer" determining the nature of the organ demanded in that area; but the skin, having come from a frog, is only competent to form a frog's mouth, which it therefore forms in place of the totally different mouth of the newt.

Such discoveries as this suggest the complexity of interaction in living tissues and the difficulty of discovering completely the causes underlying embryonic development. Mr. Waddington is optimistic in his view of experimental embryology, and his book *How Animals Develop* looks forward to future clarification of the field.

WITH PLANE, BOAT, AND CAMERA IN GREENLAND - - by Dr. Ernst Sorge

Appleton Century, $5.00

"Loneliness makes a man reflective; hardship sharpens his insight; suffering steels his will to conquer; these things educate him to full manhood."

THIS book is a description of the German expedition to Greenland in 1932, which had the double purpose of: (1) filming the fiords as background for two motion pictures, "S O S Iceberg" and a comedy; and (2) the scientific examination of the fiords and glaciers.

Sinclair Lewis has somewhere lampooned a travel book with the description "trickles of mint-flavored text around large raw hunks of illustration." Apart from some thoroughly interesting observations on, and experiments with, Greenland's glacial deposits, Doctor Sorge's prose and photography produce the reverse effect. The many cooling photographic inserts (which might be called mint-flavored) are most remarkable for their depiction of glacial phenomena, particularly the "calving" of the Rink Glacier.

Doctor Sorge made three trips to this glacier. The first time he lost his collapsible boat and was stranded. But, with spartan calm and courage, he faced eight days of privation and hand to hand grappling with the frozen wilderness aided only, mind you, by a gasoline stove, a thermos bottle, a waterproof sleeping bag, canned milk, pea soup, corned beef, pumpernickel, butter, blutwurst and coffee. And was finally located, fed, and rescued by an airplane. "It is odd," he remarks, "how soon a man can accommodate himself to a situation when there is nothing to be done about it, particularly when he is strong and fit."

The book contains very readable accounts of Eskimo life, splendid descriptions of the landscape, and is rich in highly informative material on the glaciers.

Indeed the descriptions and documentation of the book are important contributions. One only wishes that the Herr Doktor had not seen fit to justify almost every activity of the expedition, from the importation of zoo-reared polar bears for photographic purposes to the needless icy plunges of actress Riefenstahl, on the basis of his chest-thumping Prussian ideology.

LISTEN FOR A LONESOME DRUM

- - - - - by Carl Carmer

Farrar & Rinehart, Inc., $3.00

ANCIENT Seneca ritual, performed within sight of the glowing sky above the countless electric lights of Buffalo; glimpses of spiritual life one hundred miles from Manhattan where religion is not a narcotic, but a stimulant, an aphrodisiac; Red Men without faith in seemingly benevolent government legislature; White Men renouncing the federal constitution on the grounds that it nowhere mentions God; under-graduates handling game cocks; spiritualist mediums, the descendants of Noyes' communist stirpiculture;—all these Carl Carmer has found in New York, Empire State of the union.

He says, "Here men, wondering at words spoken from the bodiless air, listening for a lonesome drum, have sent their minds beyond the realm of experience, where, like eager hawks, they have seized on shining prey and brought it triumphantly to earth. Let theologians and philosophers weigh the trophies. It is enough for some of us to know the hunters and to hear the tales of the hunting."

That, it seems to your reviewer, is the fault with this book. Mr. Carmer seems to accept it as fact that the people of whom he writes, are such as they are, through causes too tenuous and fragile for the categories of science.

He has given us an unbiased, searching account of human existence throughout upper New York State. He has set down its folkways with painstaking accuracy, mimicked the various speech idioms, learned the songs, jokes, and legends of each locality; in short, done a beautiful and vigorous job of reporting. But these up-staters are for the most part, ignorant, backward people. The residents of the Bristol hills, the Chenango people, and the sundry "cracker box" characters that abound in the book—present the picture of a culture that has fallen deplorably short of its potentialities. Frontier days and ways are remarkably alive—and this would seem, in a state that boasts the largest, most technically advanced metropolis in the world, quite as much a chiding commentary on America, as a eulogy of its multifarious modes of living.

"Listen for a Lonesome Drum" in the final analysis is an excellent and honest sociological document, artfully written by a man who reveals himself but sparingly.

HIGH TRAILS OF GLACIER NATIONAL PARK by Margaret Thompson

The Caxton Printers, Ltd., $3.00

BOUND by hand, beautifully illustrated and written, this book is a refreshing example of individual craftsmanship.

Smoothly, with the effortless appeal of a good writer who knows her subject, Miss Thompson reveals the panorama of grandeur that is Glacier National Park, touching upon the history of its development, its people, and the wild life that abounds within its borders.

She makes a singularly well documented plea for a more enlightened treatment of the American Indian. She shows how, in an astoundingly short period of time, these tribes were reduced from a virile, independent people to a burden on the public dole. Since they are citizens, why, she contends, could they not benefit by legislation at least as progressive as that enjoyed by their conquerors?

Miss Thompson's book will appeal to any one interested in nature. The sportsman, the geologist, the artist and the anthropologist—all will find moments of delight in her pages.

THE CONQUEST OF YUCATAN

- - - - - by Frans Blom

Houghton, Mifflin Co., $3.50

"THE history of the greatest civilization of ancient America is like a gigantic jigsaw puzzle of which we only have some pieces."

Frans Blom, of Tulane University, is a leading authority on the Mayas, and his book is a beautifully contrived attempt to reconstruct their culture, as well as being a memorial to the Yucatan that existed before the coming of Spain, armed with cross and sword.

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- - - - - by C. L. White & G. T. Renner

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A THOROUGHLY readable work in which the author lifts geography out of the realm of factual compilation, and applies to social geography the succession concept introduced into botanical ecology by Cowles.

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- - - - - - by Rene Bache

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ANY animal fancier, particularly one whose interest lies chiefly in dogs, cats and monkeys, will find curious little gems of information, which together with the many delightful anecdotes and tales of animal heroism, make this volume one of the more illuminating in its field.

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2 June, 1936

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